FINAL

PRELIMINARY ASSESSMENT REPORT OF PFAS FORT WINGATE ARMY DEPOT (FWDA), NEW MEXICO

Prepared for:

U.S. ARMY

U.S. Army BRAC Branch DCS G-9

Contract No. W912BV20D0037

Task Order No. W912BV21F0060

AAR Document Control: 230310-01-OPS-WINGATE

September 13, 2023

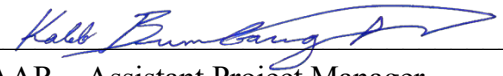
DOCUMENT REVISION TABLE

Rev. Number	Date	Description of Revision
A	June 21, 2022	Initial document for U.S. Army Corps of Engineers (USACE) review.
B	September 20, 2022	Second version to address FWDA and USACE CX comments.
C	March 10, 2023	BRAC Comments incorporated
0	March 13, 2023	Final document submittal to USACE

SIGNATURE SHEET

Contract No: W912BV20D0037

PREPARED BY:

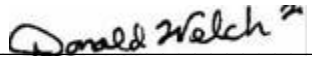


March 13, 2023

AAR – Assistant Project Manager
Kaleb Brumbaugh

Date

APPROVED BY:



March 13, 2023

AAR – Corporate Quality Manager
Don Welch

Date

CONCURRENCE BY:

March 13, 2023

AAR – Director of Environmental Services
Mark Fletcher

Date

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AAR	ARS Aleut Remediation, LLC
AFFF	aqueous film-forming foam
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
Army	U.S. Army
bgs.	below ground surface
BIA	Bureau of Indian Affairs
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act of 1980
DoD	Department of Defense
DOI	U.S. Department of the Interior
DRMO	Defense Reutilization and Marketing Office Storage Yard
EAISD	Environmental Assessment and Information Sciences Division
EDR	Environmental Data Resources, Inc.
EOD	Explosive Ordnance Disposal
ERM	Environmental Resource Management Group
FTR	Fire Test Ranges
FWDA	Fort Wingate Depot Activity
GIS	geographic information system
gpm	gallons per minute
HFPO-DA	hexafluoropropylene oxide dimer acid
HMX	octahydro-1,3,5,7-tetranitro- 1,3,5,7-tetrazocine
HMX/RDX	hand grenades, and secondary explosives
HQDA	Headquarters, Department of the Army
installation	U.S. Army or Reserve installation
MDA	Missile Defense Agency
NAICS	North American Industry Classification System
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
OB/OD	open burn/open detonation
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PBX	plastic-bonded explosives
PCTFE	polychlorotrifluoroethylene
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonate

Acronym	Definition
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
POL	Petroleum, Oil, and Lubricant
PTFE	polytetrafluoroethylene
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RSL	Regional Screening Level
SIC	Standard Industrial Classification
SWMU	Solid Waste Management Unit
TFE	tetrafluoroethylene
TNT	Trinitrotoluene
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank

EXECUTIVE SUMMARY

The objective of a Preliminary Assessment (PA) is to identify areas of potential interest (AOPIs) based on whether use, storage, or disposal of PFAS-containing materials, including AFFF, occurred in accordance with the 2018 Army *Guidance for Addressing Releases of Per- and Polyfluoroalkyl Substances* (U.S. Army 2018). A PA for PFAS-containing materials with a focus on perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutane sulfonate (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) and its ammonium salt ("GenX" chemicals) was completed at FWDA, to assess potential PFAS release areas and exposure pathways. This FWDA(FWDA) PA was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, The National Oil and Hazardous Substance Pollution Contingency Plan, the Defense Environmental Restoration Program (DERP), Army/U.S. Department of Defense (DoD) policy and guidance, *Guidance for Performing Preliminary Assessments Under CERCLA* (U.S. Environmental Protection Agency [USEPA] 1991), and the *Federal Facilities Remedial Preliminary Assessment Summary Guide* (USEPA 2005).

FWDA is located eight miles east of Gallup, New Mexico, south of Interstate 40. The depot occupied approximately 21,100 acres of land, extending across McKinley County (Headquarters, Department of the Army [HQDA] 2017)). The 1988 Defense BRAC Commission directed the closure of FWDA. The fort ceased operations in 1994, with the exception of a 6,460-acre enclave that is permitted to the Missile Defense Agency (MDA) for use as a target launch area in support of MDA's Theater Missile Defense program, now known as the FWDA Launch Complex. As of 2021, approximately 2,497.8 acres have been transferred to the Department of the Interior (DOI) and 5,854.7 acres have been transferred to the Bureau of Indian Affairs (BIA).

In conducting the PA of the BRAC property at FWDA, 16 AOPIs were identified where a potential for release of PFAS exists resulting from site operational history. AOPIs were identified at potential PFAS-release locations on FWDA.

Based on the potential PFAS releases at the AOPIs, the potential for exposure to PFAS contamination in soil exists. In addition, the potential for off-post exposure in groundwater exists, as on-post groundwater could influence downgradient drinking water sources. Given the findings of this PA, the AOPIs presented warrant further evaluation in a Site Inspection (SI).

1.0 INTRODCTION

The Army conducted this Preliminary Assessment (PA) to investigate the potential presence of Per-and Polyfluoroalkyl Substances (PFAS) at Fort Wingate Depot Activity (FWDA) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 U.S.C. §9601 et. seq.), the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et. seq.), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR Part 300), and guidance documents developed by the U.S. Environmental Protection Agency (USEPA) and the Department of the Army. FWDA is not on the National Priorities List and the Army is responsible for compliance with CERCLA in accordance with Executive Order 12580, as amended.

The purpose of this PFAS PA is to identify locations that are areas of potential interest (AOPIs) on the FWDA based on the use, storage and/or disposal of potential PFAS-containing materials, in accordance with the 2018 Army *Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances* (Army 2018). The PA was conducted in general accordance with 40 CFR §300.420(b) and the U.S. Environmental Protection Agency (USEPA) *Guidance for Performing Preliminary Assessments Under CERCLA* (USEPA 1991). This report presents findings from research conducted to assess past use of materials containing PFAS and identify areas where these materials were stored, handled, used, or disposed at FWDA.

The entire FWDA was evaluated, including Army-owned property as well as property that has been transferred out of Army control. FWDA is located eight miles east of Gallup, New Mexico, south of Interstate 40. The depot occupied approximately 21,100 acres of land, extending across McKinley County (Headquarters, Department of the Army [HQDA] 2017)). The 1988 Defense BRAC Commission directed the closure of FWDA. The fort ceased operations in 1994, with the exception of a 6,460-acre enclave that is permitted to the Missile Defense Agency (MDA) for use as a target launch area in support of MDA's Theater Missile Defense program, now known as the Fort Wingate Launch Complex. As of 2021, approximately 2,497.8 acres have been transferred to the Department of the Interior (DOI) and 5,854.7 acres have been transferred to the Bureau of Indian Affairs (BIA).

1.1 Project Background

PFAS are a group of synthetic compounds that have been manufactured and used extensively worldwide since the 1950s for a variety of purposes. PFAS are stable, man-made fluorinated organic chemicals that repel oil, grease, and water. Common industrial uses of PFAS include paints, varnishes, sealants, hydraulic fluid, surfactants, and firefighting foams. PFAS include both per- and polyfluorinated compounds. Perfluorinated compounds, such as perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluorobutane sulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA or Gen X) are a subset of PFAS with completely fluorinated carbon chains, while polyfluorinated compounds have at least one carbon chain atom that is not fully fluorinated. These six PFAS compounds together, and for the purposes of this PA, are referred to in this report as "target PFAS."

FWDA was evaluated for all potential use, storage, and/or disposal of PFAS-containing materials. There are a variety of PFAS-containing materials used in relation to historical Army

operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most common potential source of PFAS chemicals at DoD facilities. As such, this section is organized to summarize the AFFF-related sources first, and all remaining potential PFAS-containing materials in the subsequent paragraph. AFFF is used as a firefighting agent to suppress petroleum hydrocarbon fires and vapors. Firefighting foams like AFFF were developed in the 1960s (ITRC 2020a), but AFFF did not see widespread DoD use until the early 1970s. Older fire training facilities often were unlined and not constructed to prevent infiltration of firefighting foams and combustion products leaching into the subsurface. Large quantities of AFFF may have been released into the environment as a result of fire training exercises, fire responses, fire suppression system activations, and tank and pipeline leaks/spills.

Other potential PFAS sources considered include installation storage warehouses, metal plating activities, some pesticide use, automobile maintenance shops, photo processing facilities, laundry/water-proofing facilities, car washes, stormwater or sanitary sewer components, and biosolid application areas.

Many PFAS compounds are highly soluble in water and have low volatility due to their ionic nature. The specific gravity/relative density for PFOS and PFOA is 1.8 (ITRC 2020c). Long-chain perfluorinated compounds have low vapor pressure and are expected to persist in aquatic environments. These compounds do not readily degrade by most natural processes. They are thermally, chemically, and biologically stable, and are resistant to biodegradation, atmospheric photooxidation, direct photolysis, and hydrolysis. The structure of these compounds increases their resistance to degradation; the carbon-fluorine bond is one of the strongest in nature, and the fluorine atoms shield the carbon backbone.

When PFAS are released to the environment, they can readily migrate into soil, groundwater, surface water, and sediment. Once in the environment, the compounds are persistent and may continue to migrate through airborne transport, surface water, groundwater, and/or biologic uptake. The amount of PFAS entering the environment depends on the type and amount of the PFAS material that may have been released, where and when it was used, the type of soil, and other factors. If private or public wells are located nearby, they potentially could be affected by PFAS. Similarly, surface water features may be impacted and may convey PFAS to downgradient receptors.

Of the thousands of PFAS chemicals, some are considered precursor compounds (typically polyfluoroalkyl substances). Precursor compounds can abiotically or biotically transform into PFOS and PFOA. PFOS and PFOA are referred to as terminal PFAS, meaning no further degradation products will form from them (ITRC 2020b).

1.2 PA Objectives

The purpose of a PA under the NCP is to 1) eliminate from further consideration those sites that pose no threat to public health or the environment; 2) determine if there is any potential need for removal action; 3) set priorities for Site Inspections (SIs); and 4) gather existing data to facilitate evaluation for the release pursuant to the Hazard Ranking System, if warranted (40 CFR §300.420(b)(1)).

The primary objective of the PA is to identify locations at FWDA where there was use, storage, or disposal of PFAS-containing materials resulting in a potential release of PFAS to the environment and conduct an initial assessment of possible migration pathways of potential contamination. This PA also includes development of a preliminary conceptual site model (CSM) for areas of potential interest (AOPIs) related to PFAS.

1.2.1 PFAS REGULATORY OVERVIEW AND SCREENING CRITERIA

In May 2016, USEPA issued lifetime health advisories (LHAs) for PFOA and PFOS under the Safe Drinking Water Act (SDWA). To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOS and PFOA in drinking water, USEPA established an HA level for PFOS and PFOA (individually or combined) of 70 ng/L (USEPA 2016).

In October 2019, the Office of the Assistant Secretary of Defense (OSD) issued guidance on investigation PFOS, PFOA, and PFBS at Department of Defense restoration sites. The OSD guidance provided risk screening levels for PFOS, PFOA, and PFBS in (groundwater) tapwater and soil, based on the EPA Regional Screening Level calculator for residential and industrial reuse and using the oral reference dose of 2E-05 mg/kg-day. These screening levels are used during a Site Inspection (SI) to determine if further investigation in a Remedial Investigation (RI) is warranted.

In April 2021, USEPA issued an updated toxicity assessment for PFBS. USEPA developed chronic (0.0003 mg/kg-day) and subchronic (0.001 mg/kg-day) oral reference doses (RfDs) for PFBS as part of USEPA's toxicity assessment. The regional screening level (RSL) for PFBS was previously calculated using the RfD of 0.02 mg/kg day. New toxicity values resulted in revisions to the RSLs for PFBS in May 2021 (USEPA 2021).

In September 2021, OSD issued a revision to *Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program* (DoD 2021). The revised memorandum accounts for the updated PFBS screening levels attributable to USEPA's reassessment of PFBS toxicity in 2021. Based on USEPA research, the RSLs for PFOS and PFOA are calculated using an RfD of 2E-05 mg/kg-day. The RSL for PFBS is calculated using an RfD of 3E-04 mg/kg-day. When multiple PFAS are encountered at a site, a 0.1 factor is applied to the screening level when it is based on noncarcinogenic endpoints.

In May 2022, based on continued evaluation of target PFAS compounds by the Agency for Toxic Substances and Disease Registry (ATSDR) and the EPA Office of Water, EPA provided new screening levels for PFOA, PFOS, PFNA, PFHxS, and HFPO-DA.

In July 2022, OSD issued a policy memorandum adopting these new screening levels to be used during the SI-phase to determine whether further investigation in a RI is warranted. Therefore, the screening level for target PFAS compounds are: This revised guidance is in effect as of July 2022 and is applicable to investigating PFOS, PFOA, PFBS, PFNA, PFHxS, and HFPO-DA at DOD restoration sites, including BRAC (DoD 2022). Currently, no legally enforceable Federal standards exist for PFAS in groundwater, surface water, soil, or sediment.

Table 1-1. Screening Levels (SLs) from the 2022 OSD Memorandum

Chemical	Residential Tap Water HQ = 0.1 (ng/L or ppt)	Residential Soil HQ = 0.1 (µg/kg or ppb)
HFPO-DA (GenX)	6	23
PFBS	601	1,900
PFHxS	39	130
PFNA	6	19
PFOA	6	19
PFOS	4	13

Note:
The Residential Tap Water SLs are used to evaluate groundwater and surface water data. The Residential Soil SLs are used to evaluate soil and sediment data.

HFPO-DA Hexafluoropropylene oxide dimer acid
HQ Hazard Quotient
OSD Office of the Secretary of Defense
PFBS Perfluorobutane Sulfonate
PFHxS Perfluorohexane Sulfonate
PFNA Perfluorononanoic Acid
PFOA Perfluorooctanoic Acid
PFOS Perfluorooctane Sulfonate

The Army's strategy is to continue to assess and investigate potential releases and implement necessary response actions in accordance with CERCLA to ensure that no human health-based exposures are above the CERCLA risk-based values in drinking water. Therefore, sites where human exposure to contaminated drinking water exists will be addressed first and as quickly as possible to eliminate the exposure, and then will be subsequently prioritized and sequenced to conduct the investigations and response actions necessary to characterize and, if necessary, remediate the source of PFAS contamination (U.S. Army 2018).

1.3 PA Process Description

The PA for FWDA included a site visit, aerial photographic analysis, records review, and interviews that were conducted in accordance with the methods detailed in PA Quality Control Checklist (Appendix B). The Checklist outlines the approach and methodology for conducting the PFAS PA. As detailed in the Checklist, the PA activities focused on ascertaining and documenting the following information regarding PFAS history and use, storage or disposal at FWDA (40 CFR 300.420(b)(2)).

- On-post fire training activities.
- Use of PFAS-based AFFF in fire suppression systems or other systems.
- AFFF stored, used, and/or disposed of at buildings and crash sites.
- Activities or use of materials that are likely to contain PFAS constituents, such as chrome plating operations.

- Wastewater treatment plants (WWTPs) and landfills that may have received PFAS-containing materials.
- Studies conducted to assess environmental impacts at the facility.
- Potential PFAS use at parcels post transfer.
- Potential off-post sources that may impact FWDA.

The data gathered during PA activities are summarized in Sections 1.3.1 through 1.3.3 below. Section 3 provides a summary of the PA activities completed at FWDA.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POC) from the USACE, the Army BRAC organization, ARS Aleut Remediation (AAR), and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred on 03 March 2022, before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records research was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as to gather information on the physical setting and site history at FWDA.

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 05 April through 07 April 2022. An in-briefing was held to provide the on-site staff at FWDA with the objectives of the site visit and team introductions.

Personnel interviews were conducted with military and civilian individuals having significant historical knowledge at FWDA. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information. **Section 3** includes information regarding personnel interviewed.

Site reconnaissance included visual surveys that assessed the points of potential use, storage, and/or disposal of PFAS-containing materials, as well as potential secondary impacts, and the migration potential from each AOPI (e.g., stormwater drains, building drains and sumps, cracks in the floor/pavement). Physical attributes of the preliminary locations were documented, including local slope and ground and floor conditions (i.e., paved, unpaved, visual staining), surface water bodies and surface flow, potential receptors, and the distance to the installation boundary. Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for site inspection sampling. Photo documentation of the preliminary locations was collected, and access limitations or advantages related to potential future sampling activities were noted.

The findings identified during the PA were communicated during a conference call held on 07 April 2022.

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable U.S. Army Environmental Command POCs, and USACE regional POCs following the site visit. Map document files and associated geographic information system (GIS) data are provided as ***Appendix D***. GIS data layers created for the project are included in a Spatial Data Standards for Facilities, Infrastructure, and Environment-compliant geodatabase.

2.0 INSTALLATION OVERVIEW

The following subsections provide general information about FWDA, including the location and layout, the installation mission(s) over time, a brief site history, current and projected land use, climate, topography, geology, hydrogeology, surface water hydrology, potable wells within a 5-mile radius of the installation, and applicable ecological receptors.

2.1 Site Terminology

FWDA, and its other iterations (e.g., Wingate Ordnance Reserve Depot and FWDA Ordnance Depot) was developed in an 1868 treaty between the Navajo and U.S. Government in Fort Wingate, New Mexico. Native American history in the area dates prior to the acquisition of the land by the United States Government. The lands fall within the traditional territory of both the Navajo and Pueblo of Zuni people. As such, they are under the jurisdiction of the Secretary of the Interior and are managed pursuant to public land laws as well as mining and mineral leasing laws (FWDA 1998).

The maximum extent of FWDA is shown on ***Figure 2-1***. The DoD/Active Army operated FWDA until fort operations were ceased in 1994 in accordance with the 1988 BRAC legislation. Therefore, text and figure references to FWDA and FWDA indicate discussion regarding DoD/Active Army operation of the site prior to 1994.

2.2 Site Location

FWDA is located eight miles east of Gallup, New Mexico, south of Interstate 40. The depot occupied approximately 21,100 acres of land, extending across McKinley County (HQDA 2017). The 1988 Defense BRAC Commission directed the closure of FWDA. The fort ceased operations in 1994, with the exception of a 6,460-acre enclave that is permitted to the MDA for use as a target launch area in support of MDA's Theater Missile Defense program, now known as the Fort Wingate Launch Complex. Discussions related to any mission or activity prior to BRAC is referred to as "Pre-BRAC" throughout this document The layout of FWDA is shown on ***Figure 2-2***.

2.3 Pre-BRAC Mission and Brief Site History

FWDA was developed in an 1868 treaty between the Navajo and U.S. Government in Fort Wingate, New Mexico. The maximum extent of FWDA is shown on ***Figure 2-1***. In 1918, the U.S. Ordnance Department took possession of the site and used it as a storage area for excess munitions and high explosives. In 1928, it was activated as a military post. After the beginning of World War II, the installation was reconstructed and renamed the FWDA Ordnance Depot with its primary mission being munitions storage. The majority of facilities on-post were constructed after 1941.

In the 1950s and 1960s, ballistic missile testing was conducted and included testing of Redstone and Pershing 1 rockets. In 1962, the installation became part of the United States Army Supply and Maintenance Command and was redesignated as FWDA. Between 1963 and 1967, the installation was used by White Sands Missile Range to test the mobility and accuracy of the

Pershing Missile. In 1966, the installation increased activities by also shipping ammunition for the South Vietnam conflict. In 1971, the installation was placed in reserve status and was finally redesignated as FWDA The United States Army Materiel Command then reassigned FWDA operational oversight to the Tooele Army Depot (HQDA 2017, ERM Program Management Company [ERM] 1997).

Most facilities are no longer in service or have been demolished. Installation areas include administrative, workshops, magazine facilities, landfills, and open burning and detonation areas.

The administrative area is located on the northside of FWDA and consisted of office and equipment facilities. The workshop area is located south of the administration area and was comprised of ammunition maintenance facilities and renovation facilities. Most of the central portion of FWDA was comprised of magazine facilities, used for storage of ammunition (Environmental Assessment and Information Sciences Division [EAISD] 1990). Some areas were allocated for recreational purposes, but a sufficient amount of land was allocated as open burning and detonation areas and buffer zones (ERM 1997).

2.3.1 Pre-BRAC Tenants and Operations

FWDA would occasionally provide training area support for United States Army Reserve and the New Mexico Army National Guard, based at Fort Huachuca, Arizona, Gallup, New Mexico, and Albuquerque, New Mexico. The United States Army Information Systems Command conducted the operation and maintenance of the FWDA communications system. The United States Army Health Services Command conducted operations of the United States Army Dispensary. The BIA operated the Plant Management and Roads Building Programs for the Indian Reservations located in New Mexico and Arizona. The United States Department of Agriculture operated the "Navajo Donated Food Program" by the Navajo Tribe (Higginbotham and Associates, P.C 1998, ERM 1997). The entire FWDA is still under Army control.

2.4 BRAC Events

The 1988 BRAC Commission recommended that approximately 14,669 acres of FWDA be closed. In 1994, the FWDA ceased operations, except for a 6,460-acre enclave that was permitted to a tenant contractor named TPL, Inc., as well as the MDA (HQDA 2017). The extent of the area leased to MDA and determined to be surplus under 1988 BRAC are shown on ***Figure 2-3***. Beginning in 2002, the Army reassigned many FWDA operations to the BRAC Division. Command and control responsibilities were transferred to White Sands Missile Range from Tooele Army Depot in January 2008. As of 2021, approximately 2,497.8 acres have been transferred to the DOI and 5,854.7 acres have been transferred to the BIA. In January 2017, the Department of Defense (DoD) approved the Army's retention of approximately 1,300 acres if it is needed for Army or DoD missile defense missions (HQDA 2020).

2.4.1 Army Retained: Missile Defense Agency and TPL, Inc.

The MDA was a tenant prior to the BRAC closure, known previously as the Ballistic Missile Defense Organization. They launch missiles from their launch site under what is called Theater Missile Defense Program testing in Parcels 2, 9, 19, and 20.

TPL, Inc. leased numerous facilities under an Industrial Operations Command Facilities Contract in Parcels 6, 21, 22, the administrative area, Igloo Block B, most workshop area buildings, and support systems since 1994. For some time between 1994 and 2005, they also leased igloos in Igloo Block D. In 2005, however, they were returned to Army control. They utilized these facilities for the dismantling conventional military munitions/energetic materials and reclaiming their contents for re-use. TPL, Inc. operations continued until 2007. For a number of years, they were a Large Quantity Generator (NMR00000216) of hazardous wastes consisting of fuses and fin assemblies (CH2M Hill 2010).

2.4.2 Department of the Interior and Bureau of Indian Affairs

Pursuant to the 1988 BRAC event, the Army filed a notice of intent to relinquish its reservation of the lands with the Secretary of the Interior. The DOI will hold lands under its jurisdiction upon satisfactory completion of environmental restoration and clearance of unexploded ordnance, with the intent of eventually transferring the lands in trust to the Navajo Nation and Pueblo of Zuni, upon agreement by the two tribes.

2.5 Climate

FWDA climate is semi-arid, with spring and fall droughts. Summer precipitation accounts for the majority of rainfall in the year, with 11 inches accumulated on average. Average temperatures range from 64 degrees Fahrenheit to 36 degrees Fahrenheit. Extremes in temperature range between 0- and 100-degrees Fahrenheit (USACE Mobile District 1995). During winter, daily temperature fluctuate as much as 50 to 70 degrees Fahrenheit in a 24-hour period. There are 100 to 150 frost-free days during the year from May to October. During spring, the area experiences strong winds from the west and southwest, with an average wind speed of 12 miles per hour. Strong winds, low relative humidity's, and high temperatures contribute to high evaporation rates (TerranearPMC 2009).

2.6 Geology

FWDA is located within the Navajo section of the Colorado Plateau Physiographic Province and at the northwestern edge of the Zuni Mountains. It is in a basin that was formed during the creation of the Zuni Mountains. It has been furthered shaped by differential weathering and erosion (Pika 2015).

To the south of FWDA is the Zuni Mountain Range. To the north lies remnants of the Chinle Formation from the Triassic period and alluvial deposits. The Chinle Formation consists of calcareous mudstone that can be observed at the bottom of arroyos. The easily erodible mudstone formed into arroyos. The Chinle Formation also consists of minor amounts of fine-grained calcareous sandstone. The sandstone is relatively weather resistant (ERM 1997). It is the dominant formation exposed at FWDA and can be up to 800 ft thick (Pika 2015).

The oldest exposed bedrocks are Glorieta Sandstone and San Andres Limestone, of Permian age. They exist on the southeastern corner of the installation, dipping steeply to the west and north beneath Triassic strata. They are overlain by Chinle claystone and surface alluvium of the Rio Puerco Valley. These formations are capable of yielding water.

Alluvial formations from the Quaternary period are also capable of yielding water. The alluvial deposits are a result of the sediments that flow down the braided streams from the Zuni Mountains and the Hogback. The Hogback is a long, narrow hill or ridge with steeps sides. The Hogback in the area is a monocline fold that dips westerly (ERM 1997). The grain size of the sediment ranges from clay to gravel. The thickness of the deposits varies through the installation, but it is the thickest near major drainages. Alluvial deposits not located adjacent to the major drainages can be less than 15 feet thick. The alluvium has been shown to be 150 feet thick northwest of the installation near the South Fork of the Puerco River. In the Administration Area, a water supply well record indicates a 30-foot-thick alluvial deposit, while another well record 30 feet away indicates a 70- foot-thick alluvial deposit (ERM 1997).

The Hogback runs along the southwestern and western side of the installation and is thought to represent a monocline fold, where westerly dipping Mesozoic bedrock is exposed to form a long, sharp-crested ridge trending north to south. The bedrock in areas east of the Hogback generally dips to the north. It defines the west and southwest margin of the Zuni uplift (Pika 2015).

2.7 Topography

FWDA lies within three topographic areas: 1) the rugged north-to south trending Hogback along the western and southwestern boundaries; 2) the northern hill slopes of the Zuni Mountain Range in the southern portion; and 3) the alluvial plains marked by bedrock remnants in the northern portion of the installation (***Figure 2-4***). During rainfall, streams transport sediment to low-lying portions of the installations, creating alluvial deposits by bedrock remnants. The elevation of FWDA ranges from 6,600 feet above mean sea level in the north to 8,200 feet above mean sea level in the south (TerranearPMC 2009).

2.8 Hydrogeology

Groundwater is present in several of the rock units underlying FWDA. The formations capable of yielding water are the Quatowam Alluvium from the Quaternary period and the San Andres Limestone and Glorieta Sandstone from the Permian period. The Chinle Formation and other underlying rocks can yield minor amounts of groundwater.

The alluvial aquifer located on the northern edge of the installation is composed of gravel, sand, silt, and clay derived from rocks of Triassic and Jurassic age. It is discontinuous, shallow, and unconfined. The aquifer is recharged from surface runoff and springs in the southern part of the installation, but high permeabilities of the sand, sandy loam, and sandy loam clay soils at FWDA allow for potential influence of soil impacts into the alluvial aquifer in the northern portion of the installation. However, low rainfall and high evaporation potential tend to reduce the local impact of soil contamination to groundwater. The saturated thickness of the alluvial aquifer varies and tends to increase as it nears drainage channels (ERM 1997). In general, depths to water in the alluvium range from 20 to 30 ft bgs.

The San Andres-Glorieta aquifer is the primary groundwater source for FWDA. The top of the San Andres-Glorieta aquifer lies about 1,100 feet below land surface in the Administration Area, and the aquifer is about 200 feet thick and under artesian pressure (Pika 2015). The recharge

zone is located east of a fault in the southeastern part of FWDA, where the formation is exposed. Groundwater flow for the aquifer is in a northwesterly direction (ERM 1997). Groundwater from the San Andres-Glorieta aquifer flows upward along fractures due to the upward hydraulic gradient. The region around Gallup, including FWDA, was declared an underground water basin in 1980 by the State of New Mexico. This action prohibits any major new groundwater withdrawals without the approval of the State Engineer. The basin covers 1,439 square miles and includes the communities of Gallup, Fort Wingate, Camerco, Mariano Lake, Navajo Wingate Village, and Rehoboth (ERM 1997).

2.9 Surface Water Hydrology

Drainage in the FWDA area is intermittent, usually occurring during heavy rainfall or snowmelt. Streams are fed by the Zuni Mountain Range and the Hogback. Drainage generally flows north into the South Fork of the Puerco River (ERM 1997).

Generally, there are few surface water features due to the semi-arid climate, but there are several ephemeral streams and manmade channels. The South Fork of the Puerco River runs through FWDA. The Puerco River then joins into the Puerco River and Little Colorado River watersheds (Pika 2015).

There are two manmade lakes and one pond located in the FWDA area. Lake McFerren is located on the southeastern boundary of the installation in a wooded area. Lake Knudson is a shallow intermittent lake located near the intersection of two drainages in the northern portion of the installation. The unnamed pond is located on the eastern portion of the installation along the Eastern Patrol Road (ERM 1997).

FWDA has three major surface water drainage systems defined by bedrock ridges or bedrock remnants. In the northwest part of FWDA, two artificial channels divert water away from Igloo Blocks A and B and the administration and workshop areas and leads to the South Fork of the Puerco River. The eastern drainage system flows to the northwest and northeast on the slopes of Zuni Mountain. Drainage from the northeastern part of FWDA flows around bedrock remnants before joining the South Fork of the Puerco River. The western drainage system primarily has two main drainage tributaries. One tributary passes the demolition area, while the other cuts across the Hogback and creates Fenced-up Horse Valley. The tributaries then join to form a main drainage flowing north (EAISD 1990).

There is a fourth minor drainage system in the southwest corner of FWDA, but it is hydrologically isolated from other parts of the depot. This system flows southwest and joins the Bread Springs Wash on the western side of the Hogback (EAISD 1990).

The surface water hydrology for the site is shown on ***Figures 2-2*** and ***2-4***.

2.10 Relevant Utility Infrastructure

The following subsections provide general information regarding the installation's stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and transport of PFAS at FWDA.

2.10.1 Stormwater Management System Description

The FWDA stormwater system consists of culverts, bridges, and drainage channels. The Puerco River is the ultimate receiver of both storm water runoff and sanitary drainage. The storm sewer system serves the administrative area and discharges to the open drainage system. Stormwater runoff containing grease, oils, fertilizer, and solvents is allowed to infiltrate the soil of the area (EAISDANL 1990).

2.10.2 Sewer System Description

Domestic sewage for the FWDA administrative area was collected through a sewer network and gravitationally drained to the now closed Sewage Disposal Plant northwest of the administrative area. There the sewage received treatment prior to being discharged to a surface drainage. The Sewage Disposal Plant had three stabilization ponds, an unlined evaporation-infiltration lagoon, and three sludge drying beds. A septic tank was constructed around 1954 and was added to provide basic treatment in the event that flow through the control house needed to be bypassed. It led through vitrified clay pipe towards an outfall to the north. The Sewage Disposal Plant ceased operations after 2013 (USACE Fort Worth District 2013).

Septic tanks and drain fields were used to collect sewage in isolated areas of FWDA not connected to the former Sewage Disposal Plant. (EAISDANL 1990). There were three septic tanks located in the administrative area. One septic tank is located west of the Guard House, one located east of Building 14 near the corral, and one south of the Ammunition Workshop in Building 542 (EAISDANL 1990).

Limited industrial activities were performed at FWDA. Hazardous liquid wastes including explosives, leachate, acid, thinners, waste oils and solvents were generated in the Trinitrotoluene (TNT) Washout Building, paint shops, and vehicle maintenance facilities. Liquid hazardous waste generated at FWDA included waste, oil, solvent, and antifreeze from the Vehicle Maintenance Facility and Locomotive Shop. Waste oil was reportedly disposed off-site by the Defense Reutilization and Marketing Office (DRMO). Used solvent was picked up by the supplier for recycling/recovery off site (EAISDANL 1990).

2.11 Potable Water Supply and Drinking Water Receptors

The Glorieta sandstone/San Andres limestone forms the major aquifer of the region, which supplied FWDA with potable water through two artesian wells (#68 and #69) located in the Parcel 11 Administration Area. The wells intercepted the aquifer at more than 1,000 ft bgs. The two deep wells were plugged and abandoned in 2023 in coordination with the New Mexico Office of the State Engineer (NMOSE). Shallow, water-bearing alluvial sands, silts, and clays that are hydraulically separated from the deeper regional aquifer occur along the northern edge of FWDA. These alluvial aquifers are recharged by surface runoff. The shallow groundwater table is discontinuous and has low yield, with an average depth to water of 20 to 30 ft bgs.

During the operation of FWDA, untreated water was used for firefighting and irrigation. Potable water from the deep artesian wells was treated and chlorinated in Building 2 prior to distribution.

Approximately 7,800 gallons of water were used per day during operation (Department of the Army 1991). No such activities are being conducted since closure.

An EDR report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for the FWDA, which along with state and county GIS provided by the installation identified several off-post public and private wells within five miles of the installation boundary (***Figure 2-5***). The EDR report providing well search results provided as ***Appendix D***.

2.12 Ecological Receptors

The PA team collected information on ecological receptors that was available in the installation documents reviewed. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

There are three major plant communities that make up the installation: the Rocky Mountain/Madrean Montane coniferous forest, the Great Basin coniferous woodland, and Great Basin desert scrub. The plant communities vary with soil type and elevation (USACE Mobile District 1995).

Common resident animals on the installation include the side-blotched lizard (*Uta stansburiana*), yellow-rumpled warbler (*Dendroica coronate*), lesser goldfinch (*Carduelis lawrencei*), coyote, and mule deer.

Typical resident species of desert scrub include short-homed lizard *(Phynosoma douglasi ornatissimum),* western diamondback rattlesnake *(Crotaks atrox),* roadrunner (*Geococcyx californianus),* thirteen-lined ground squirrel *(Spermophilus tridecimilineatus hollisteri),* bobcat (*Lynx rufus),* and black-tailed jackrabbit *(Lepus californicus).* Woodland species include many avian residents such as pinyon jay *(Gymnorhinus cyanocephalus),* house finch *(Carpodacus mexicanus),* downy woodpecker *(Picoides pubescens),* acorn woodpecker *(Melanerpes formicivorus),* and transients such as American robin *(Turdus migratorius),* western flycatcher *(Empidonax difficilis),* and hooded warbler (*Wilsonia citrina).*

The Mexican spotted owl (*Strix occidentals lucida),* a Federally threatened species is located in the FWDA region and may occasionally be within FWDA boundaries as transitory birds. Zuni fleabane *(Erigeron rhizomatus),* a Federally-threatened species; Arizona leather flower *(Clematis hirsutissima var. arizonica),* a Federal Candidate 1 species; and Acoma fleabane *(Erigeron acomanis),* Grama grass cactus *(Pediocacws papyracanthus),* Sivinski fleabane *(Erigeron sivinskii),* and cinder cone phacelia *(Phacelia serrata),* Federal Candidate 2 species, are known to occur in the FWDA region (USACE Mobile District 1995).

2.13 Previous PFAS Investigations

No previous PFAS investigations relative to FWDA or area in near proximity were identified for review.

2.14 Exposure/Migration Pathways and Targets

The evaluation of potential exposure and migration pathways and the resulting targets (i.e., receptors) for PFAS in soil, surface water, groundwater, and/or air for the potential AOPIs at the site is presented below.

2.14.1 Soil Exposure Pathways and Targets

The use, storage, or disposal of PFAS-containing material at FWDA is likely to have occurred at multiple AOPIs. The primary source of PFAS impacts for the site is AFFF and it is likely to have been used and potentially released to the ground surface at the Fire Training Ground and Building 5 Maintenance Garage. AFFF is known to have been stored at the Fire Station and Building 15 Maintenance Garage. AFFF may have been released to the ground surface as part of routine training (e.g., nozzle training) at fire stations, AFFF storage areas, and vehicle washout locations. Additional areas of potential PFAS impacts to soil include the Sewage Disposal Plant. The PFAS impacts to soil may remain ~~present~~ near the AOPIs (described further in Section 5.1) and may present exposure pathways for direct contact. Potentially affected targets include potential residents, potential recreationalists, commercial workers, and potential construction workers as described below:

- Potentially affected existing targets for direct contact to potentially impacted soil includes commercial and construction workers. The potential for workers to be in direct contact with potentially impacted soils is generally low as the potential release areas are in locations not commonly accessed (e.g., roadsides and landfills). Access to the site as a whole is generally restricted by fencing and security, and the potential for residential and recreational target exposure is relatively low because there are no existing residences or designated recreational opportunities near AOPIs.

2.14.2 Surface Water Migration Pathways and Targets

A well-developed surface water drainage system is present at the site as detailed in Section 2.9. Drainage generally flows north into the South Fork of the Puerco River (ERM 1997). Surface water at the site has potential to be an exposure and migration pathway as precipitation drains over and through potential surface soil impacts and enters the intermittent drainages. Potential surface water exposures are possible on-site and off-site as surface water originating on the site exits FWDA.

- Targets for potential surface water impacts on-site include site workers who may rarely access intermittent surface water bodies for maintenance activities or environmental remediation efforts. Potential for residential and recreational target exposure is relatively low because there are no existing residences or designated recreational opportunities near AOPIs.
- Off-site targets include workers, residents, and recreational users that may enter the intermittent surface water drainages or surface water bodies (e.g., Puerco River) as off-site access is uncontrolled.

2.14.3 Groundwater Migration Pathways and Targets

Groundwater is present at the site and is potentially impacted by releases of PFAS containing materials from soil at the AOPIs. As described in ***Section 2.6***, high permeabilities of the sand, sandy loam, and sandy loam clay soils allow for potential influence on the discontinuous, shallow, unconfined alluvial aquifer in the northern portion of the installation. However, low rainfall and high evaporation potential tend to reduce the impacts of soil contamination on the alluvial aquifer, resulting in more localized impacts. shallow soils at the site generally exhibit low permeability with precipitation being more likely to enter the local surface water system than entering the underlying aquifers. Recharge to these aquifers come primarily from surface runoff and springs in the southern part of the installation.

- On-site exposure to groundwater via ingestion is not anticipated to be an existing exposure pathway as the remaining water well at the site (located near the fire station as shown on ***Figure 2-5***) is not used for potable purposes and all other known wells are used for groundwater monitoring. Furthermore, the potable water resource for this formerly potable well is the San Andres-Glorieta aquifer, which is confined by many impervious layers which prevent percolation of contaminants into the deep aquifer. However, if there are not land use controls on site in the future, future residential, commercial, and construction targets may exist if new potable wells are developed or the existing well receives treatment for potable use.
- Public water supply wells are present along the northern boundary of FWDA (***Figure 2-5***). One of these wells (White Cliffs Mobile Home Park) is erroneously indicated on the EDR report to exist within the FDWA boundary. However, further investigation has established that this well exists north of the area currently indicated, outside FDWA boundaries. There are five public water supply wells within 1.5 miles of the installation boundary. The depth of groundwater withdrawal is unknown and may represent residential, commercial, and construction targets. There is a possibility for off-site use of shallow groundwater.

2.14.4 Air Migration Pathways and Targets

PFAS impacts in soil or surface water present from pre-BRAC closure releases are unlikely to volatize and/or migrate through air under normal atmospheric pressure, pH, and temperatures. A potential may exist for surficial soil with PFAS impacts to dry and become airborne as dust at the release point (e.g., a fire training area exposed to AFFF). Such potential exposure pathways would be limited to the site and the potential targets would include commercial workers and construction workers that may be working near the source area.

Figure 2-1: Site Location

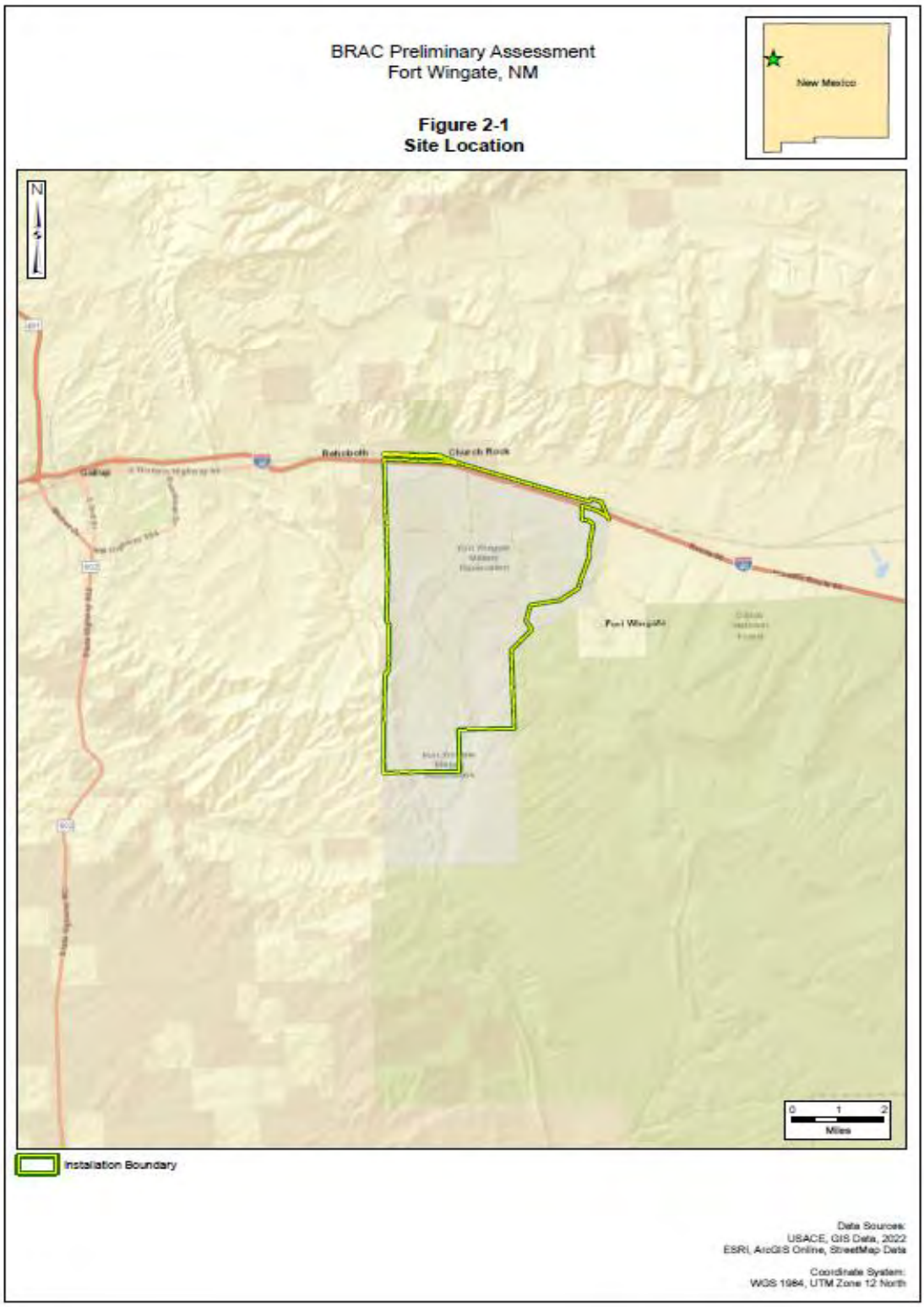


Figure 2-2: Site Layout

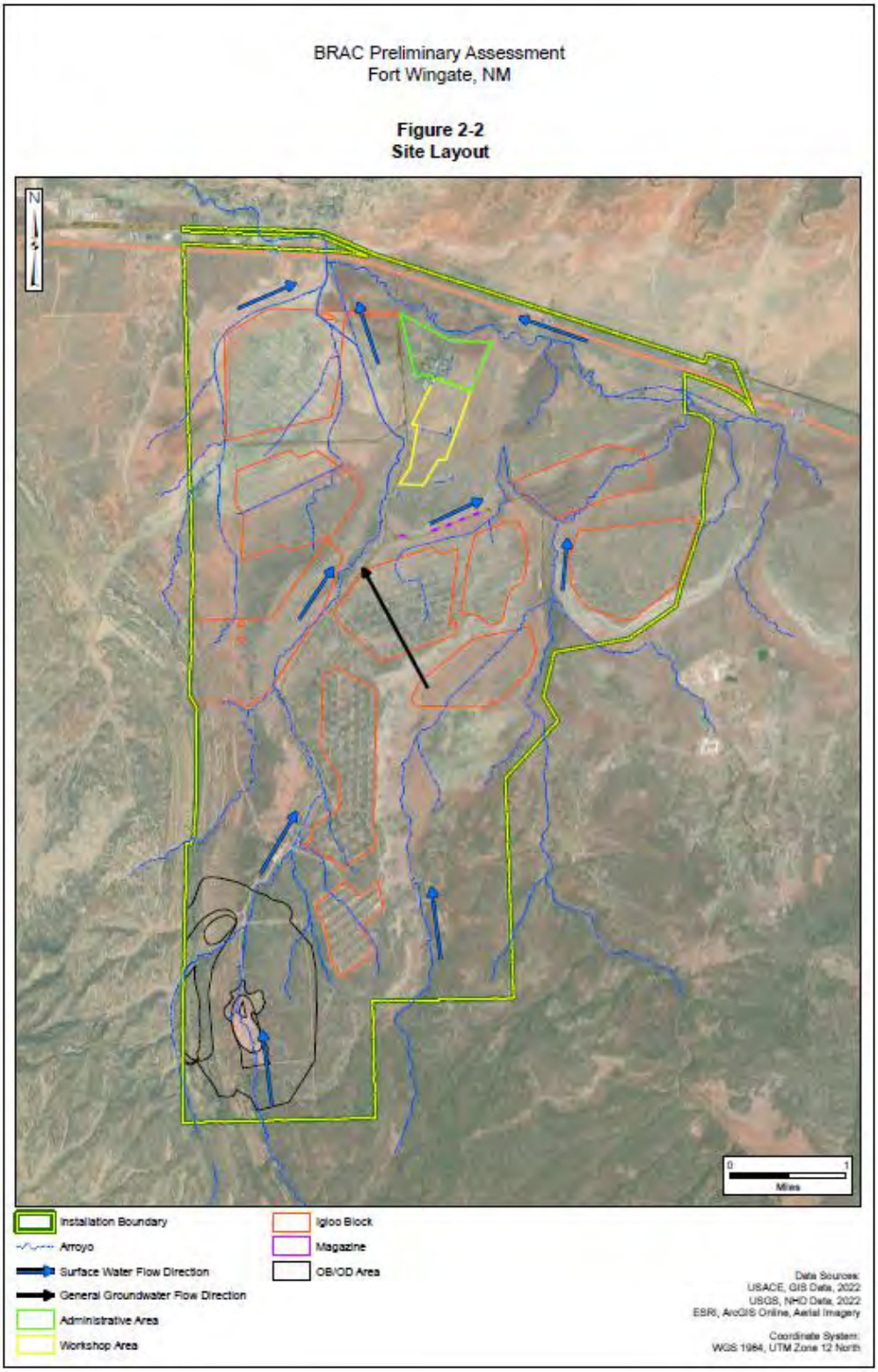


Figure 2-3: Parcel Status

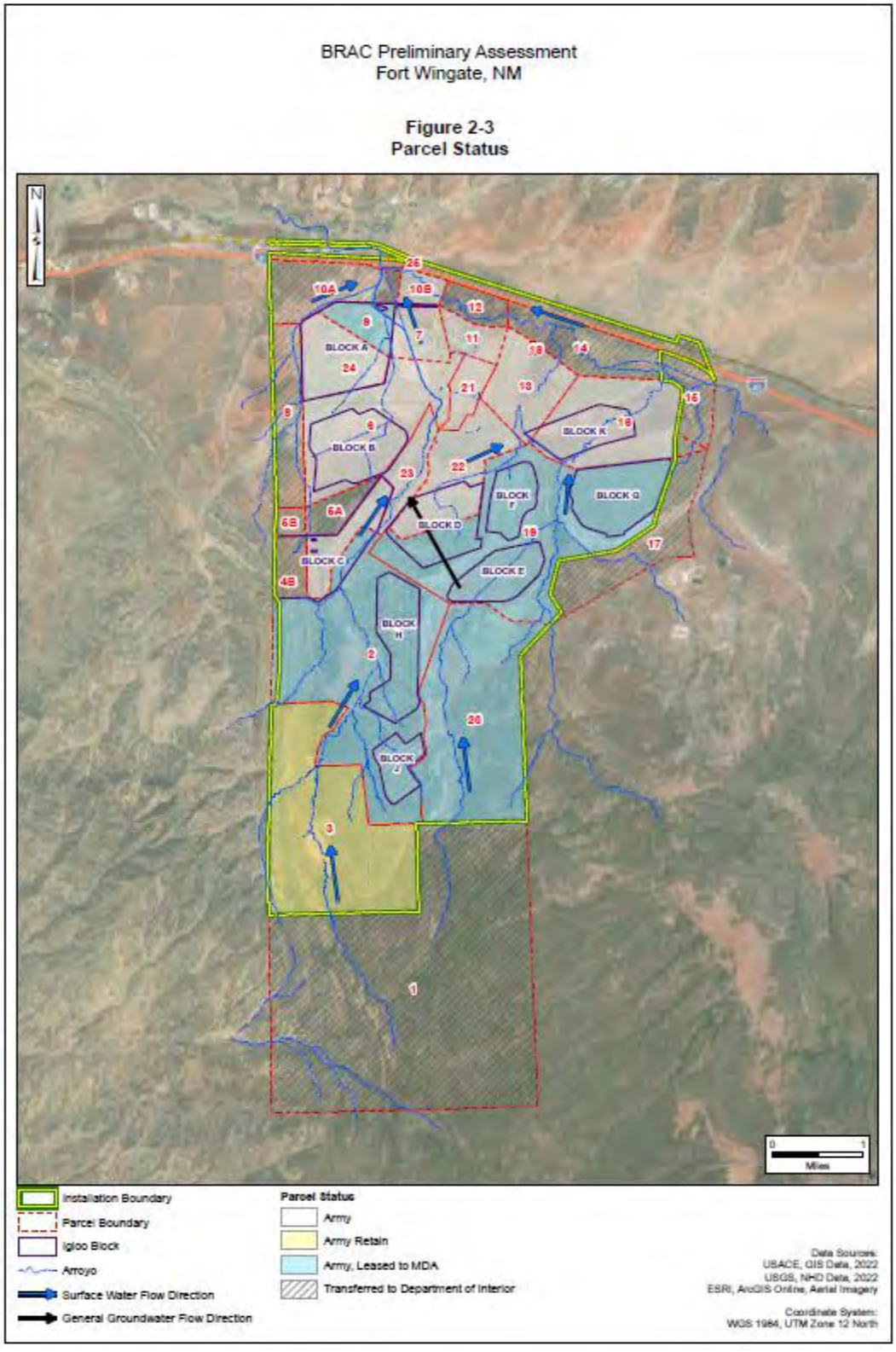


Figure 2-4: Topographic Map

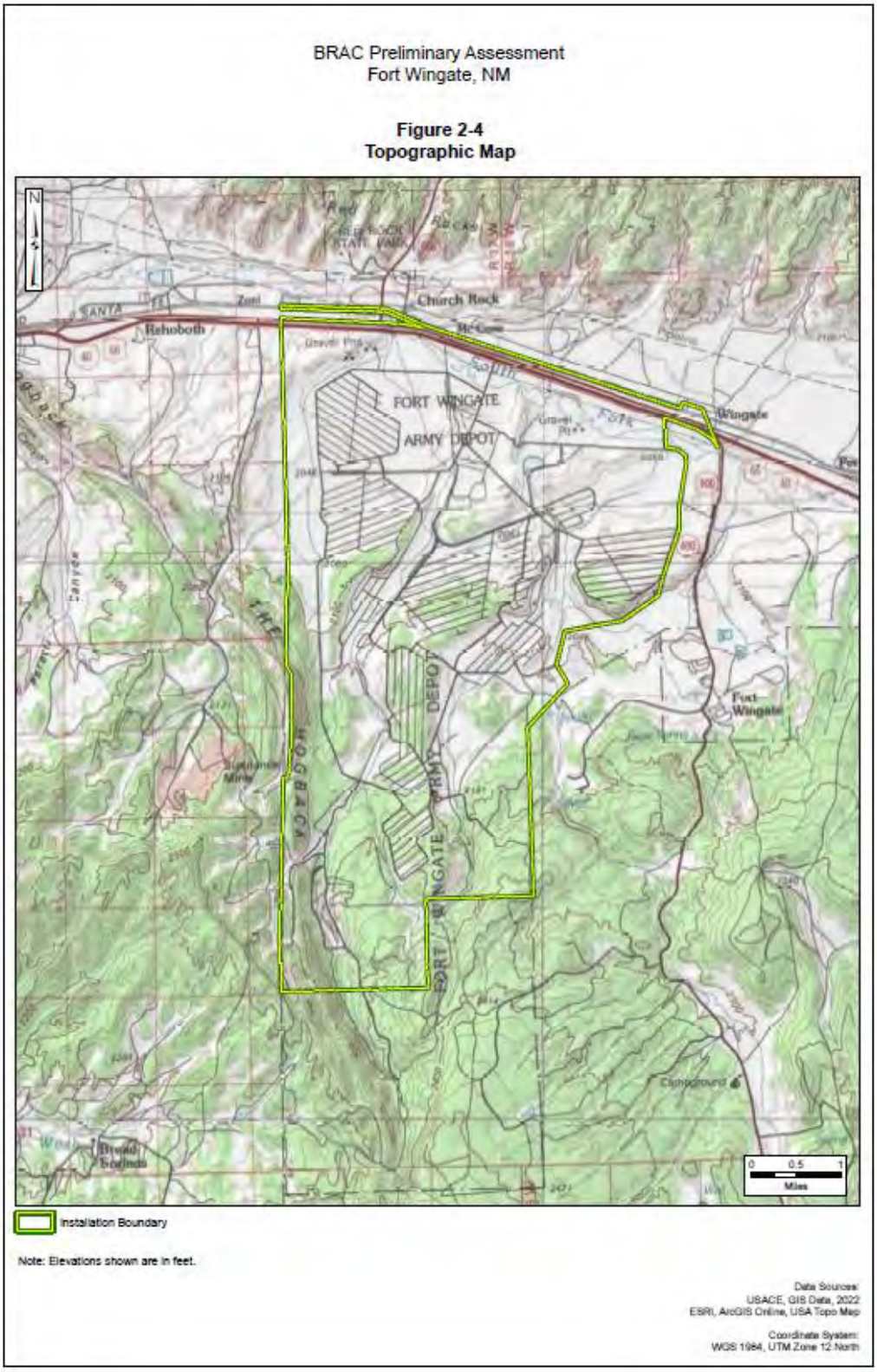
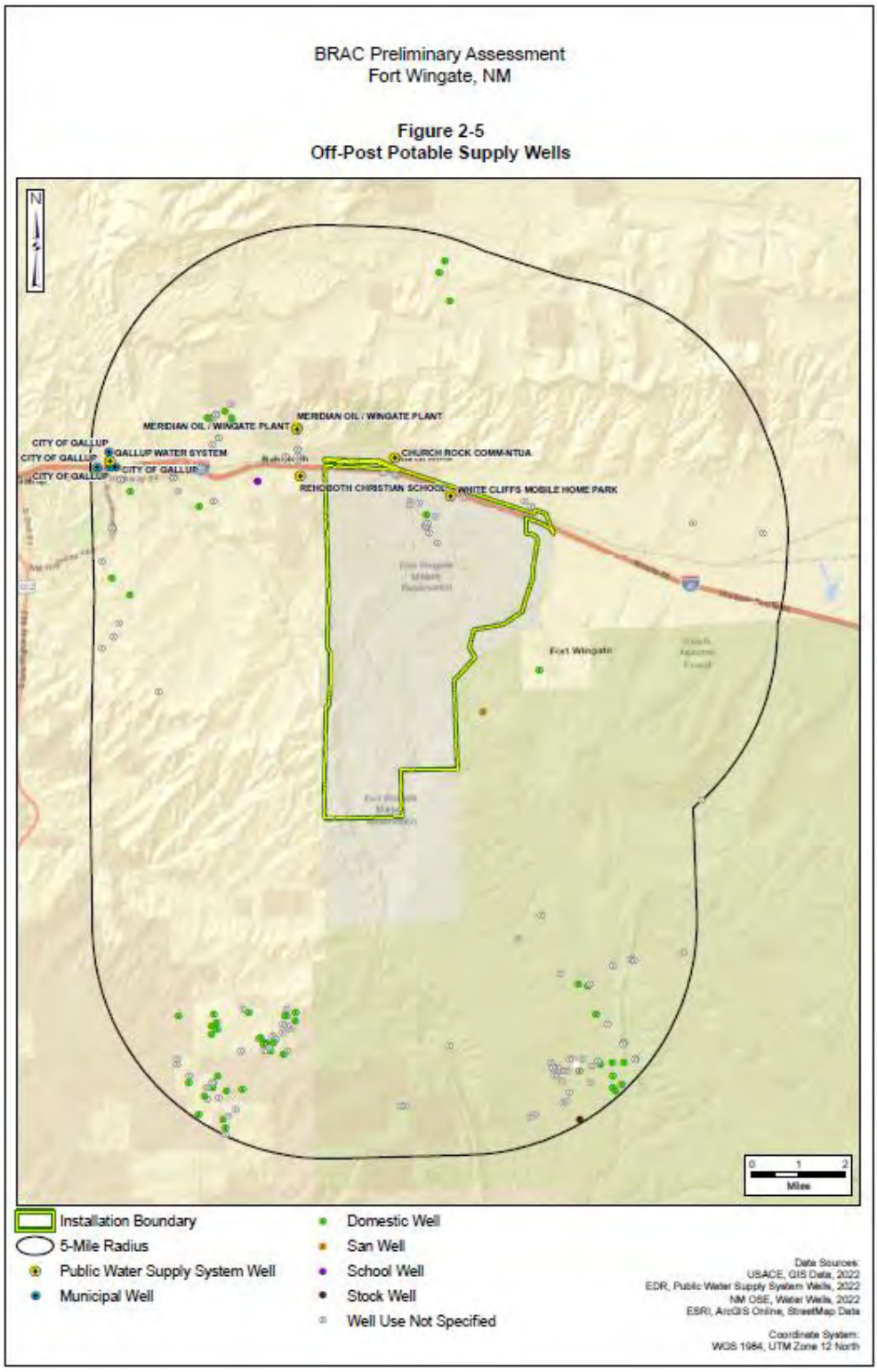


Figure 2-5: Off-Post Potable Supply Wells



3.0 SUMMARY OF PA ACTIVITIES

To document areas where any potential current and/or historical PFAS-containing materials were used, stored and/or disposed at FWDA, data were collected from three principal sources of information:

1. Records review,
2. Personnel interviews, and
3. Site reconnaissance.

These sources of data, along with their relative application to this PA, are discussed below. The specific findings of records review, personnel interviews, and site reconnaissance relevant to PFAS-containing materials at FWDA are described in **Section 4**.

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program administrative record documents, compliance documents, FWDA fire department documents and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for FWDA is provided in ***Appendix E***.

3.2 Personnel Interviews

Interviews were conducted during the PA site visit.

However, in the years since the 1988 BRAC closure decision, most DoD personnel associated with the Active Army at FWDA had transferred to alternate assignments and/or retired or have passed away. Therefore, interviewees with recollections of historical site activities were typically unavailable. Additionally, the Active Army records from FWDA were transferred off site and pre-1994 environmental records were not available. Former Fire Department staff at FWDA were interviewed during the PA process. The compiled interview logs provided in ***Appendix F***.

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at FWDA during the records review process, the installation in-briefing, and/or during the installation personnel interviews. A photo log from the site reconnaissance is provided in ***Appendix G***; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in ***Appendix H***.

Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for future sampling. Much of the installation's infrastructure was left in disrepair before the recommendation for transfer and was later demolished.

Preliminary locations of potential use, storage, and/or disposal of PFAS-containing materials were then evaluated in the PA (during records review, personnel interviews, and/or site reconnaissance) and were categorized as AOPIs or as areas not retained for further investigation

at this time based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches). A summary of the observations made, and data collected through records reviews (***Appendix E***), installation personnel interviews (***Appendix F)***, and site reconnaissance logs (***Appendix H***) during the PA process for FWDA is presented in **Section 4**. Further discussion regarding rationale for not retaining areas for further investigation is presented in **Section 5.2**.

4.0 POTENTIAL PFAS USE, STORAGE, AND/OR DISPOSAL AREAS

FWDA was evaluated for all potential historical use, storage, and/or disposal of PFAS-containing materials. The PA evaluation for FWDA identified potential PFAS containing materials at the site to be limited to the use and storage of AFFF. This section is organized to summarize the specific AFFF-related uses at FWDA followed by a presentation of additional PFAS-containing materials potentially used at the site.

4.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5 percent (%) hydrocarbon surfactants, and 1 to 3% PFAS (Interstate Technology Regulatory Council 2020). AFFF concentrate is designed to be diluted with water to become a 1, 3, or 6% foam. AFFF releases at DoD facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases from storage areas and/or firefighting vehicles. The military still primarily uses AFFF for Class B fires; however, the current formulations of AFFF contain significantly lower amounts of PFOS, PFOA, and their precursors, and significant operational changes have been implemented to restrict uncontrolled releases and non-essential use of PFAS-containing foams. Army installations may still house AFFF, commonly stored in closed containers (e.g., 55-gallon drums, 5-gallon buckets), within designated storage buildings or at firehouses.

As described in **Section 3.2**, due to the time interval since the 1988 BRAC closure recommendation, interviewees with recollection of historical site activities not typically well documented in environmental records, like AFFF or even general firefighting foam inventory data were scarce. However, the timeline of firefighting activities, the types of firefighting activities, and commonly known firefighting behaviors provide contextual insight on the types of foam being utilized.

Emergency preparedness procedures practiced by the FWDA Fire Department regarding nozzle testing (spraying AFFF through fire equipment to ensure proper consistency and flow of extinguishing material; avoiding blockages), wet lining (spraying diluted concentrations of AFFF or AFFF through a foam nozzle device to prevent the spread of fires) or arc training (training to maximize the arc, reach, and distance covered by AFFF) were not available through interviews or document review.

For emergency preparedness, fire department personnel may be trained to performed nozzle testing with AFFF to ensure optimal flow and use of the AFFF mixture. Nozzle testing involved spraying AFFF through fire equipment. Fire equipment training also can include arc training to maximize the arc, reach, and distance covered by AFFF in an emergency response. Emergency responses are not well documented in FWDA records.

Firefighting training activities were confirmed, based on documentation and interviews, to have occurred at the Fire Training Ground. The Fire Training Ground was constructed in 1925, according to historical documents. The Fire Training Ground prior to the BRAC closure

consisted of three stations: the fire pit, the railcar, and the Christmas tree. The FWDA Fire Department would train here in addition to hosting neighboring fire departments (e.g., Gallup Fire Department, BIA firefighters). In 1970, two fire pits were added, a central pit and a northern pit. A fill pipe would supply fuel to the central pit. It is unclear if the pits were lined. The fill pipe would route fuel, solvents, or oil to serve as a fueling source. The fill pipe ran from the western edge of the site and connected to a discharge outlet on the bottom of the central pit, approximately 150 feet away. The pits were no longer in use by 1990.

Records at FWDA indicate that there was one fire station built at FWDA in its history. The fire station was built in the 1940s and remained in operation until installation until operations ceased. The fire station (located in Building 34) housed fire protection equipment and personnel. Activities included filling fire extinguishers, and machining and grinding metals. In the 1960s, the station housed fire trucks with a capacity of 750 gallons per minute (gpm), 500 gpm, and 375 gpm. According to an interview from a former FWDA firefighter, the fire station housed multiple 5-gallon buckets of AFFF. The interviewee also reported that the firefighters would respond to minor spills with AFFF. However, no records of Fire Department spill response procedures or records of where they may have responded to spills have been identified. FWDA administration reported that prior to the BRAC event, fire and spill response records were disposed of annually.

In addition to firefighting activities at FWDA, the former FWDA firefighter reported that 5-gallon buckets of AFFF were also stored in Maintenance Garage, Building 15. Originally, the building was used as a maintenance shop for heavy equipment and automotive maintenance. It then served as a storage for waste and equipment. The waste stored in the building included waste oils, solvents, and greases. The waste being stored here may have served as the fuel source for fire training. It has been reported that the building has been generally inactive since the FWDA closure in 1993 (USACE Fort Worth District 2013).

4.2 Other PFAS Use, Storage, and/or Disposal Areas

Following document research, personnel interviews, and site reconnaissance at FWDA, the Former Deactivation Furnace, three Fire Test Ranges (FTRs), the Former Ammunition Painting Building and Acid Washout Pond, the Former TNT Washout Building and Former TNT Leaching Beds, the Ammunition Workshop, the Petroleum, Oil, and Lubricant (POL) Waste Discharge Area, the DRMO Storage Yard, the Sewage Disposal Plant, and a landfill were reviewed as potential PFAS use, storage, and/or disposal areas. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas retained as AOPIs is presented in **Section 5.1** and specific discussion regarding areas not retained for further investigation is presented in **Section 5.2**.

4.2.1 Metal Plating

Potential PFAS use associated with metal plating activities may also be relevant to Army installations. During metal plating operations, a metal surface may be treated with a layer of electrochemically deposited metals in an acid bath. PFAS, specifically PFOS, have been used in

metal plating operations as surface tension-reducing wetting agents to mitigate the release of aerosolized chemicals into a working environment. Hard chromium plating is one type of metal plating operation where PFAS-containing mist suppressants were commonly used. Historically, it was common for spent plating baths from metal plating operations to be disposed of in a lined or unlined pit or into a sanitary or storm sewer. Therefore, PFAS present in mist suppressants during the metal plating process could be released to the environment. However, during the PA, no evidence of metal plating was identified to have occurred at FWDA.

4.2.2 Pesticides

Sulfuramid, flursulamid, novaluron, nifluiridide, and lithium PFOS are among several insecticides which are formulated with PFAS. The Army PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

4.2.3 Paints, Coatings, and Lubricants

PFAS are known to be used as wetting agents, pigment dispersants, and binder emulsifiers in paints (Gluege et al. 2020). In doing so, they support reduced foaming, and increase the properties of paint levelling, oil repellency, and resistance to dirt. Enamels containing PTFE have been used in military operations (Armed Services Technical Information Agency 1961). Further, they are used in metal coatings to promote flow of coatings, prevent cracks in the coating during drying, and can serve as a corrosion inhibitor on steel. On May 05, 1970, patent US3511682A of the US Department of Navy was published. US3511682A patents a process of applying Teflon® films. The process can be used for governmental purposes without payment of royalties. This patent details a green, PTFE-containing enamel produced by DuPont, known as the One Coat Enamel (US Department of Navy 1970). This enamel was not identified in any chemical lists reviewed during the PA process.

The Former Ammunition Painting and Acid Washout Pond was used as a paint shop to paint metal surfaces. The metal surfaces were pickled prior to painting them. Acid solutions used to pickle surfaces of metal parts prior to painting them were discharged without treatment to the holding pond and allowed to evaporate and infiltrate into the ground.

PFAS serve in lubricants to prevent rusting, allow mechanisms to operate without forming a sludge that could cause mechanical failures, and secure seals. The U.S. military specified a lubricant for use with ammunition which had a 20% fluorocarbon telomer dispersion in 1,1,2-trichloro-1,2,2-trilfluoroethane. This specification existed from 1965 to 1998 (Army MU 1965). A list of lubricants utilized at FWDA was not available for review.

4.2.4 Maintenance

Areas that may have performed maintenance on munitions were also evaluated due to the potential exposure to PFAS containing products such as lubricants, paints and munitions, or in the heated disposal processes. Disposal areas were identified as potential areas of PFAS contamination if they received oils or solvent waste or if they received demilitarized munitions.

However, a full list of chemicals utilized as the installation were not available for review and PFAS content could not be identified.

The Former TNT Washout Building and Former TNT Leaching Beds, located in Building 503, utilized hot water to clean and wash off specific munitions resulting in an explosive slurry. Overflow from the Former TNT Washout Building drained into the Former TNT Leaching Beds until 1967. The Ammunition Workshop and Ammunition Normal Maintenance Building performed a variety of operations such as ammunition maintenance, modification, painting, and demilitarization. Operations at the Ammunition Workshop also included the recovery of HMX/RDX, a secondary explosive, in which steam washout operations were used.

4.2.5 Disposal

Disposal areas were also evaluated due to the potential exposure to PFAS containing products. Disposal areas throughout FWDA included the POL Waste Discharge Area, the DRMO Storage Area, the Sewage Disposal Plant, and the Central Landfill. The POL Waste Discharge Area was used until 1975. The area was reportedly used to dispose of waste oils and solvents that may have contained PFAS. Approximately 200 gallons per year of POL wastes were dumped directly onto the ground. The DRMO Storage Yard was used to store construction wastes, waste oils, and solvents beginning in 1962. Records available for review did not list any materials identified to contain PFAS. The Sewage Disposal Plant had three stabilization ponds, an unlined evaporation-infiltration lagoon, and three sludge drying beds. The Sewage Disposal Plant received waste from various sources through the sanitary sewer that may have been impacted with PFAS-containing material from the administrative area. The Central Landfill received sewage sludge from the Sewage Disposal Plant from 1969 to 1982.

4.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at FWDA) is not part of the PA. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below.

To the west of the FWDA lies Gallup, New Mexico with four smaller towns stationed between. To the east of the FWDA lies the City of FWDA(not associated with FWDA). The area between the two towns is not very populous and businesses are scarce.

One mile east of the FWDA boundary is the City of FWDAFire Department. Interviews with former fire department staff indicate that the City of FWDAFire Department would train with AFFF at the FWDA Fire Training Ground. Therefore, it was possible that they could have responded to fires or oil spills with AFFF.

PFAS is known to be used in specific industries. The EPA has identified sectors under the North American Industry Classification System (NAICS) and Standard Industrial Classification (SIC) system which are associated with PFAS in their operations. Facilities within 5 miles of FWDA that are categorized under these industrial classification sectors have been identified below.

These facilities may be primary or secondary sources of PFAS based on their historical operations.

Market West Hydrocarbons is an inactive chemical manufacturing plant (SIC code 2869: Industrial Organic Chemicals). The company provided transportation, fractionation, storage and marketing of natural gas and the gathering and transportation of crude oil. It was located approximately four miles west of FWDA.

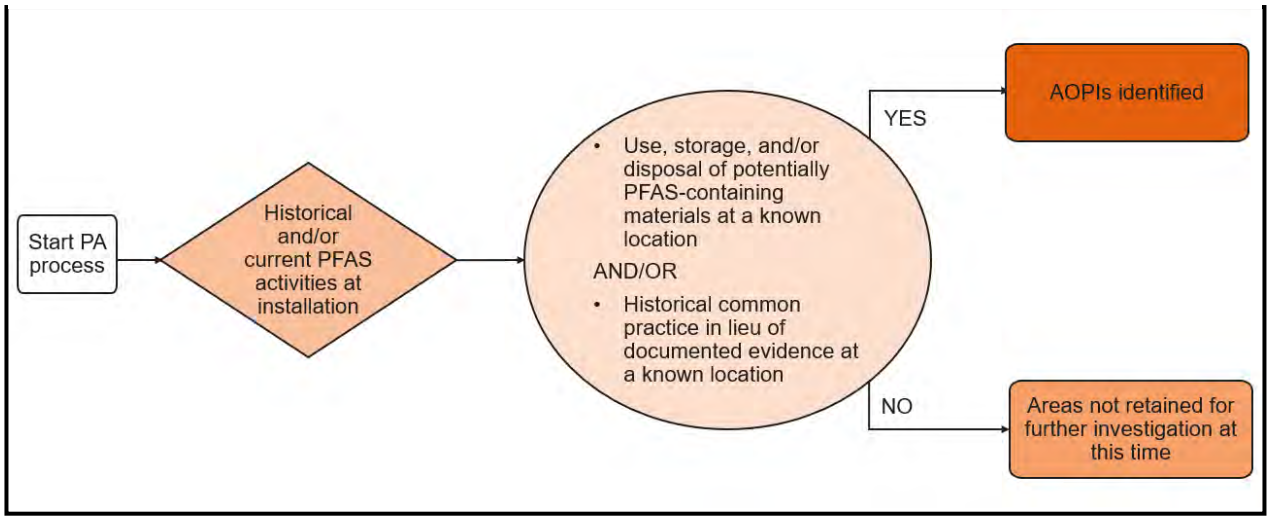
Church Rock Mine is an inactive uranium mining and refining company that operated from 1967 to 1982 (SIC code 1094: Uranium-Radium Vanadium Ores and NAICS code 212291: Uranium-Radium-Vanadium Ore Mining). It was located approximately three miles northwest of FWDA.

Western Refining – Wingate Facility is an active oil and gas plant. It has operated under several NAICS codes. Those that have been related to PFAS are 21113: Natural Gas Extraction, 21112: Crude Petroleum Extraction, 32419: Petroleum Lubricating Oil and Grease Manufacturing, and 324110: Petroleum Refineries. The plant provides storage for natural gas, crude oil loading and transportation capabilities through a rail loading terminal and pipeline. It is located approximately three miles west of FWDA. A local newspaper article reported a tanker truck tipped over into a ditch, spilling gasoline it had been carrying. It was described that the tanker was leaving the "Giant Refinery". The Western Refining – Wingate Facility is located adjacent to Giant Crossing Road and may be the refinery referenced in this article. Refinery firefighters, the Gallup Fire Department, and the FWDA Fire Department all reportedly responded to the spill.

5.0 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage, and/or disposal of PFAS-containing materials at FWDA, were further refined during the PA process and identified either as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA, 6 areas have been identified as AOPIs on ***Figure 5-1***, below.

Figure 5-1: AOPI Decision Flowchart



The areas not retained for further investigation are presented in **Section 5.2**.

Data limitations for this PA at FWDA are presented in **Section 6**.

5.1 AOPIs

Overviews for each of the 6 AOPIs identified during the PA process are presented in this section. The AOPI locations are shown on ***Figure 5-2***. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on ***Figures 5-3*** through ***Figures 5-6***. None of these AOPIs have been transferred.

5.1.1 Fire Station

The Fire Station is identified as an AOPI following records research, personnel interviews, and site reconnaissance. The Fire Station is located in Building 34 in Parcel 11 and is shown on ***Figure 5-3***. The Fire Station housed fire protection equipment, which was confirmed to include AFFF by former FWDA personnel. There was not sufficient storage capacity in the Fire Station to house the depot's complete AFFF inventory, so it would also be stored in the building 15 Maintenance Garage (which also served as a warehouse). The building is comprised of a garage to the west and an attached living space to the east. In the 1960s, the station housed fire trucks that had spray capacities of 750 gallons per minute (gpm), 500 gpm, and 375 gpm. The fire truck with 375 gpm spray capacity was identified as a Class 750 fire truck. FWDA did have fire trucks

which had the capacity to carry and deploy AFFF. These trucks used inductor tubes to mix the AFFF concentrate with water.

An aerial photograph of the Fire Station is provided on ***Figure 5-3***. The Fire Station is located in the administrative area with grassy area to the south and north. Runoff would likely flow to the west toward the street, where there was no apparent stormwater drain nearby. The street runs from north to south.

5.1.2 Building 5 Maintenance Garage

Building 5 Maintenance Garage is identified as an AOPI following records review and site reconnaissance due to probable fire vehicle maintenance and washing being conducted here. Building 5 Maintenance Garage is located within SWMU-5 in Parcel 11, as listed on the 2014 RCRA Permit. Building 5 Maintenance Garage is located in the administrative area, across the street from the Fire Station. It was used since the 1940s for vehicle maintenance and washing. A wash rack is located outside of the building, to the west. Fire trucks with AFFF residual on them may have been washed here, where wash water would have then flowed to the Sewage Disposal Plant.

An aerial photograph of Building 5 Maintenance Garage is provided on ***Figure 5-3***. The area is located on a flat, paved area. Runoff from washing activities would have flowed into the wash rack, which flowed to the Sewage Disposal Plant.

5.1.3 Building 15 Maintenance Garage

Building 15 Maintenance Garage is identified as an AOPI following records review, interviews, and site reconnaissance due to the area having been used for AFFF storage. Building 15 Maintenance Garage is located within Parcel 11, as listed on the 2014 RCRA Permit. Building 15 Maintenance Garage is located in the administrative area, north of Building 5 Maintenance Garage. Prior to 1980, it was used for mixing insecticides and pesticides. From 1980 until closure, it was used for AFFF storage and minor maintenance activities. With the exception of RCRA Facility Investigation for groundwater in 2019, no other environmental investigation or cleanup has been performed at this AOPI.

An aerial photograph of Building 15 Maintenance Garage is provided on ***Figure 5-3*** and is located in Parcel 11. The area is flat and paved. Runoff would have flowed into interior drains, which flowed to the Sewage Disposal Plant.

5.1.4 Fire Training Ground

The Fire Training Ground is identified as an AOPI following records research, personnel interviews, and site reconnaissance. The Fire Training Ground is located within SWMU-7 in Parcel 11, as listed on the 2014 RCRA Permit. The FWDA Fire Department would train here with the Gallup Fire Department, personnel from the New Mexico State Fire Marshal's Office, and the BIA. These grounds were used at least three times a year for BIA firefighter training and biannually for FWDA Fire Department Training (USAEHA 1988).

The area consists of at least one fire training pit (identifiable during the PA site visit) and a rail car, used as a smoke house, which was removed prior to the PA site visit (***Figure 5-4)***.

Interviewees and historical documentation repeatedly refer to two training areas, one confirmed to have existed in the central portion of the Fire Training Ground, and the other in the gravel parking area (although at one point, it was thought to have been located in the southeastern portion of the Fire Training Ground but was confirmed to not be the case; USAEHA 1988, Argonne National Laboratory 1990, Metcalf & Eddy, Inc. 1992, ERM Program Management Company 1997, TerranearPMC 2008, TerranearPMC 2012). The Fire Training Ground is bordered to the north by a gravel parking area, which predates the development of the area for firefighter training. Previous investigations have found no apparent evidence of the northern pit, presuming that if it had existed, it was graveled over. Historic aerial photographs show that this parking area has been paved or graveled since the 1960s.

The confirmed fire pit is located in the northeastern portion of the Fire Training Ground and is about 10 feet in diameter. This fire pit was used for diesel- and gasoline-based firefighter training, where AFFF would be used as the extinguishing media. As much as 55 gallons of fuel would be dispensed as a fuel source. A fill pipe at the western edge of the site, along the eastern edge of the parking area, was formerly connected to a discharge outlet on the bottom of the main pit, approximately 150 feet away. This pipe has been excavated and removed as part of a 2011 RFI and disposed of at an off-site recycling facility, but the discharge outlet piping still remains.

One interviewee recalled one fire pit as being lined with a gravel layer on top of it. Neither gravel nor a liner was observed during the PA site visit in the confirmed fire pit, nor were they in photographs or descriptions from previous investigations.

The Fire Training Ground was also used for Christmas (or "X-mas") tree firefighter training. This Christmas tree was a steel, tree-shaped tower outfitted with valves and holes in order to dispense liquid propane gas and ignited. AFFF would not be used as extinguishing media for this exercise. Historic photos indicate that this training occurred roughly in the same location as the confirmed pit.

Historic photographs obtained from the University of New Mexico Library show both Christmas tree firefighter training and oil pit firefighter training occurring in the northeastern portion of the Fire Training Ground. These photographs also show that fire trucks would be staged in the gravel parking area.

An aerial photograph of the Fire Training Ground is provided on ***Figure 5-4***. The area is flat, vegetated, and covers an area approximately 250 feet by 500 feet in size. It is fenced, and at one point surrounded by an earthen berm. Runoff flows toward the confirmed fire training pit. With the exception of RCRA Facility Investigation for groundwater in 2019, no other environmental investigation or cleanup has been performed at this AOPI.

5.1.5 5.1.5 Sewage Disposal Plant

The Sewage Disposal Plant is identified as an AOPI following records review due to the suspected accumulation of PFAS-containing material from various sources through sanitary sewer system. The Sewage Disposal Plant is located within SWMU-10, as listed on the 2014 RCRA Permit. The Sewage Disposal Plant received waste from the Former TNT Washout Building, Building 5 Maintenance Garage, and Building 15 Maintenance Garage. Overflow from the system may enter an open drainage ditch located north of the installation, which flows into the South Fork of the Puerco River. Some historic data indicates that a septic tank, connected to the Sewage Disposal Plant, was located north of the Sewage Disposal Plant where the plant discharged into the South Fork of the Puerco River.

An aerial photograph of the Sewage Disposal Plant is provided on ***Figure 5-5*** is located in Parcel 11. Concrete infrastructure still remains. Earthen beds are still visible, and is surrounded by earthen drainage ditches, which lead toward the north. The South Fork of the Puerco River is located north of the AOPI.

5.1.6 Central Landfill

The Central Landfill is identified as an AOPI following records research due to potentially PFAS-containing sludge from the Sewage Disposal Plant being disposed of here. The Central Landfill is located within SWMU-21, Parcel 23, as listed on the 2014 RCRA Permit.

The site is located southwest of the administrative area in Parcel (***Figure 5-6***). An arroyo runs from south to north on the western portion of the landfill.

5.2 Areas Not Retained for Further Investigation

Through the evaluation of information obtained during records review, personnel interviews, and/or site reconnaissance, the areas described below were categorized as areas not retained for further investigation at this time (i.e., non-AOPIs). The locations of the non-AOPIs are shown on ***Figure 5-7***.

A brief site history and rationale for areas not retained for further investigation is presented in ***Table 5-1***, below.

Table 5-1: Installation Areas Not Retained for Further Investigation

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
Former TNT Washout Building and Former TNT Leaching Beds*	1948 - 1967	Former TNT Washout Building and Former TNT Leaching Beds are located within SWMU-1, as listed on the 2014 RCRA Permit. Off-spec munitions would be cleaned and washed off after they were unpacked and broken down. The explosives were recovered through a process where hot water was used to flush out the munitions. The munitions contained TNT, RDX, or Tritinol, and the resulting explosive slurry was pumped into a storage and drying tank to eventually be shipped to various ammunition plants for reuse. The bottom soil	Interviews and physical records available for review did not identify PFAS-containing materials as having been used, stored, or disposed of here.	Fort Wingate

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
		from the leaching beds was removed and burned in the Old Burning Ground.		
Ammunition Workshop*	1949 - 1967	The Ammunition Workshop was located within SWMU-11, as listed on the 2014 RCRA Permit. It had been identified as Building 542, located in the workshop area. It was used as an ammunition packing, shipping, and receiving building. Records indicate that a variety of ammunition maintenance, modification, and demilitarization operations (e.g., component recycling and recovery of HMX/RDX using steam) were performed at this location. This building was connected to a septic tank, cesspool, and drain field located to the southwest.	Interviews and physical records available for review did not identify PFAS-containing materials as having been used, stored, or disposed of here.	Fort Wingate
Ammunition Normal Maintenance*	1955 - Unknown	Building was used for ammunition demilitarization, milling, and tapping, spray painting, and stenciling. Materials used in this operation included oils, greases, solvents, paint, and paint thinner, propellants, explosives, and metals. RDX was detected in a subsurface soil sample. Updated deluge system in the 1980s with upgrades suspected to be AFFF, but later confirmed to be a dry powder.	Interviews and physical records available for review did not identify PFAS-containing materials as having been used, stored, or disposed of here.	Fort Wingate
Former Deactivation Furnace*	1950 – 1986	The Former Deactivation Furnace is located within SWMU-72, as listed on the 2014 RCRA Permit. Located in Building 530 in the workshop area, it was used for a variety of demilitarization activities. From the late 1950s to the late 1960s cartridges and small arms ammunition were melted to recover the metals they contained. Thermal destruction ended in the early 1970s. From 1982 to 1986, the furnace was used to demilitarize white-phosphorus munitions. Explosives were removed from the munitions prior to arriving at the deactivation furnace. White phosphorus was then burned off so the metal could be recovered	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate
Petroleum, Oil, and Lubricant (POL) Waste Discharge Area*	Unknown - 1975	The POL Waste Discharge Area is located within SWMU-9, as listed on the 2014 RCRA Permit. Located in west of the administrative area, the area was reportedly used to dispose of waste oils and solvents. Waste was dumped directly onto the ground and it was reported that the soils appeared to be saturated with oil. Used until 1975 when the area was covered with clean soils and usage as a disposal area was discontinued. 200 gallons a year of POL and solvents were disposed of at this location. Dumping occurred as the direct pouring of wastes onto surface soils. The suspected discharge area was approximately 7820 square feet in size and visible staining and dark toned material were observed in the area until 1978.	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate
DRMO Storage Yard*	1962 - Unknown	The DRMO Storage Yard is located within SWMU-3, as listed on the 2014 RCRA Permit. Beginning in 1962, the site was used to store construction wastes, waste oils, and waste lubricants. Since 1970, the area was used to store items being transferred to the DRMO at Kirkland Air Force Base, or while awaiting pickup by a recycling contractor. Items stored in this area included waste oil, waste antifreeze, and spent solvent stored in 55-gallon	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
		drums. Upon inspection, staining was observed across the area.		
New Open Burn/Open Detonation (OB/OD) Area*	1955 - 1992	OB/OD activities were transferred here from the Old OB/OD Area in 1955. Open detonation of high explosives was conducted in various locations across the OB/OD area. The burning ground area is two acres in size. It has been used to burn propellants and propellant-contaminated materials. Prior to 1982, all wastes were burned in unconfined settings. Since, they have been burned in two troughs and trays. Burn residue would be taken to the Demolition Area Residue Piles (FTW-5). The demo area was used as a dumping ground for explosives-contaminated material that had not been deconned. Ten demolition pads existed at this location in 1981.	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate
Old OB/OD Area*	1948 - 1955	The Old OB/OD Area is located within SWMU-14 and SWMU-15, as listed on the 2014 RCRA Permit. This area was used to burn explosives and explosive-contaminated materials beginning in 1948 until 1955 and is located on the southwestern portion of the installation. The Old OB/OD Area also includes the Old Burning Ground and Demolition Landfill (SWMU-14) as well as the Old Demolition Area (SWMU-15). The Old Burning Ground and Demo Landfill was used to receive explosive-contaminated wastes from the Former TNT Washout Building and Former TNT Leaching Beds. Soils from the Former TNT Leaching Beds were removed and burned at the Old Burning Ground. The bottom soil was removed and burned for the last time in 1967. Old equipment from the Former TNT Washout Building renovation was reportedly dumped in the arroyo here without being decontaminated from explosive-contaminated material or washed.	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate
Functional Test Range 1*	1960 - 1967	Functional Test Range 1 is located within SWMU-38, as listed on the 2014 RCRA Permit. It was used to test flares, signals, simulators, screening smoke, hand grenades, and secondary explosives (HMX/RDX). Test activities were conducted in the east-central portion of FWDA, between Igloo Blocks E and H. Originally used as a powder burning area in the 1940s, the area began being used for flare and signal grenade testing during the 1950s. Residues were piled on the bank of an arroyo near the eastern part of the area. It was reported that scrap metal and shrapnel were observed over a large portion of this area. High explosive rockets and mortar rounds were tested here between 1960 and 1967.	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	MDA
Functional Test Range 2/3*	1950 -1960	Functional Test Range 2/3 is located within SWMU-16, as listed on the 2014 RCRA Permit. Located in northeastern FWDA, the test ranges encompass 585 acres. Functional Test Range 2 was used in the 1960s to test a variety of munitions, rockets, and mortars. It was mostly vegetated, except for a small area in the northeast portion which is more sparsely vegetated. Functional Test Range 2 and 3 were used to test flare and signal grenades. Piles of fins from rockets were found here. Functional Test Range 3 was used in the 1960s to test high explosives and contained many craters.	Interviews and physical records available for review did not identify PFAS-containing materials as having been disposed of here.	Fort Wingate; Bureau of Indian Affairs

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
Dispensary - Building 2	1942 - Unknown	X-ray activities may have occurred here. However, none were identified. If present, waste would have flowed through the Sewage Disposal Plant, which is an AOPI.	No indications of PFAS containing materials.	Fort Wingate
Motor Fuel Station - Building 6	1941 - Unknown	Building was historically used as a vehicle fuel station. The building was equipped with two gasoline dispensing units, one kerosine dispensing unit, two gasoline storage tanks, one diesel fuel storage tank, and one kerosine storage tank.	Fuel was stored in UST, but there is no indication of a fire response at this location.	Fort Wingate
Machine Shop - Building 9	Unknown	Activities included welding, cleaning metal parts, electrical repairing, disposal of fluorescent tubes, and use of coolants, solvents, etc. Smokestack indicated in field interviews suspected of being location of burning activities. Upon further investigation, this smokestack was related only to a furnace.	No indications of PFAS containing materials.	Fort Wingate
Herbicide Storage Area - Building 29	1943 - Unknown	Historically used for the storage of herbicides and pesticides. The chemicals were reportedly stored in leak-proof containers on the concrete floor.	Herbicides information provided did not indicate PFAS in formulations.	Fort Wingate
Road Oil Storage Tanks - Building 58-60	1944 – Unknown	Historical use includes storage for road oil.	No reason to suspect spills or application of oil would indicate AFFF response.	Fort Wingate
Fire Reporting and Guard Lookout Tower - Building 67	1944 - 1961	Used for spotting brush fires. Potential location where AFFF was stored.	No record of AFFF being stored at the Lookout tower. Used for spotting brush fires. Fire station would not often respond to brush fires due to UXO issues.	Fort Wingate
Primary Collector Barricade - Building 509	1948 - Unknown	Supported operations conducted in the Ammunition Disassembly Building (Bldg. 522). Building was used to collect propellant (e.g., smokeless 16 powder) removed from munitions being disassembled in Bldg. 522. Propellant removed from munitions was conveyed to Bldg. 509 via an overhead vacuum. Containers were placed in Bldg. 509 to collect the recovered propellant. When containers were filled, they were closed and moved to Bldg. 507 and Bldg. 508 to await transport either to longer term storage or to the OB/OD Area for burning.	No indications of PFAS containing materials.	Fort Wingate
Vacuum Producer Building - Building 510	1948 - Unknown	Contained equipment to produce the vacuum used to convey recovered propellant from Bldg. 522 to Bldg. 509. There was a possible use/release of lubricants and maintenance chemicals associated with the machinery in Building 510. Building housed a centrifugal vacuum pump to pull debagged smokeless powder propellant from Bldg. 522 to Bldg. 509. Building housed two secondary separator units to remove potential explosion hazards (propellant dust) from the air being drawn by the vacuum pump. It is presumed that the dust/sludge was collected in containers and transported to the OB/OD Area for treatment.	No indications of PFAS containing materials.	Fort Wingate

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
Former Ammunition Painting / Acid Washout Building and Pond – Building 515	Late 1940s – Late 1960s	Materials held in the building included acid solutions used to pickle surfaces of metal parts prior to painting them. Sand blasting was conducted to clean munitions, followed by the application of paints to the exterior. The Former Acid Waste Holding Pond is located adjacent to the western side of the Former Ammunition Painting/Acid Washout Building (Bldg. 515). Solutions used in the building were discharged without treatment to the holding pond and allowed to evaporate and infiltrate into the ground.	Fluorinated (PFAS) surfactants in paints can be added as an emulsifier for the binder, dispersant for the pigment, and as a wetting agent. No specific information on the paint used for stenciling was available. Fluorinated paints first patented in 1970s, after operations at Building 515 ceased.	Fort Wingate
Ammunition Renovation Building - Building 522	1948 - Unknown	Building contained a deluge system and an automatic annunciator system. The building was used for ammunition packing during WWII, but then used for demilitarization. Disassembly would occur here, preparing for further processing in other buildings. Building did not feature any munitions washout areas and records do not indicate any hydrocarbon-based contamination issues.	No indications of PFAS containing materials. Staff indicated that deluge systems would not be a source of PFAS (dry powder, not AFFF). Demilitarization did not include munition washout.	Fort Wingate
Flammable Materials Storage - Building 529	1855 - 1988	Historically used as a flammable materials storehouse.	The chemicals were reportedly stored in leak-proof containers on the concrete floor. No record of fire. No indications of PFAS containing materials.	Fort Wingate
Inspectors Workshop and Ammunition Renovation Depot - Building 536	1943 - Unknown	Consisted of areas for inspection and testing of various munitions including ammunition storage room, inspection room, gauge room, test fixture for rocket motors, pull apart machine and barricade, and a repair room. TPL operation began around 1996 and included demilitarization of munitions and processing of propellent into smokeless power for commercial resale. Their operations included demilitarization of munitions and processing of propellent into smokeless power for commercial resale. Building was updated with new deluge system in 1986 confirmed to be a dry powder, not AFFF.	No indications of PFAS containing materials.	Fort Wingate

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
Pesticide and Field Battery Shop - Building 537	1941 - 2008	Building 537 had a concrete floor and was well ventilated. The building served as a field battery shop, where forklifts and batteries were serviced. There is a wash rack located to the west of the building. Historical uses include melting bulk propellants and mixing and storing pesticides/insecticides in leak-proof containers. Pesticides/insecticides included Chlordane, Malathion, Dieldrin, Diazinon, Chlorpyrifos, Pyrethrin, Calcium Cyanide, Anticoagulant rodenticide bait anticoagulants, PMP, and warfarin.	Pesticides/ insecticides were stored in leak-proof containers. PFAS-containing pesticides not indicated on inventories.	Fort Wingate
Above Ground Storage Tank	Unknown - 1999	Tanks contained petroleum products for use in roadway maintenance, heating, or emergency power generation. ASTs were used for asphalt/coal tar storage for use in road maintenance, to store diesel/heating oil used to heat the Deactivation Furnace at Bldg. 530, to store diesel fuel for use in the emergency generator located in Bldg. 11, and to store diesel/heating oil used to heat the OB/OD Area Break Room (Bldg. 601).	No records of fire response of spill response.	Fort Wingate
Helipad	Unknown	The Helipad was a temporary helicopter landing area. It was used in support of Depot operations, and occasionally by the Army Reserve and National Guard during weekend and annual training periods.	No record of fires or fire training occurring in the area.	Fort Wingate
Igloo D1147	2001	Area where contaminated propellant was burned. Propellant became unstable after TPL personnel applied a chlorine solution to disinfect rodent droppings present in propellant bags. This propellant was open burned on the road in front of the building in December 2001. Propellant was laid out in a pile 6 inches wide by 1 inch high by 100 feet long down the center of the asphalt paved road. Sources indicate it may have been 300 lbs. or 5,000 lbs.	Records indicate AFFF was not used during the burning of the propellant.	Fort Wingate
Proposed Burning Ground	Unknown	The Archive Search Report describes this area as a proposed burning ground location. The ASR determined that there was never a burning ground placed at this location	Proposed to be used as a burning ground, but never put into service. No indications of PFAS containing materials.	Fort Wingate
Eastern/Old Landfill	1948 - 1968	Prior to 1968, the Old Landfill was used for the routine burial of garbage, trash, and debris generated at FWDA. In addition, solid waste was burned, and pesticide containers and ACM were reportedly disposed of. From 1948 to 1955, explosive-contaminated waste was disposed of here. In 1968, the Old Landfill was covered by a layer of soil. In October 1999, surface debris was removed from the area of the landfill. The material removed consisted of metal ammunition lids, wire rope, I-beams, pipe, tires, wire fencing, concrete blocks, expended ammunition casings, scrap wood, and tree branches/trunks.	Explosive-contaminated waste predates potential PFAS use in munitions.	Fort Wingate
Group C Landfill	Unknown	Located south of the Igloo Block C area, the scrap metal and railroad logs were disposed of here. The use dates are unknown. Ammunition shells were also present. The site was excavated in 1999.	No indications of PFAS containing materials.	MDA
Western Landfill Area	Prior to 1948 - 1993	This landfill was made up of four elongated areas or closed trenches, 100 feet in length and 50 feet in width, oriented generally from north to south. Waste consisted of	No indications of PFAS containing materials.	Fort Wingate

Area Description	Dates of Operation	Relevant Site History	Rationale	Land Ownership
		nonhazardous materials generated during the warehousing, packaging, and demilitarization of munitions, with a few exceptions. Primary types of waste included metal banding, various types of wood debris, plastic debris, electrical wiring, and construction and demolition debris. Minor types of waste included glass, ash, automobile parts, and a few crushed metal and plastic containers. Trenches of this landfill were excavated shortly before BRAC closure. 120 demilitarized projectiles and demolition debris thought to be associated with the Deactivation Furnace were found in one trench.		

*Area is not retained for further investigation but there is data gap due to lack of adequate information (e.g., records available for review, or knowledgeable personnel available for interview), as described in **Section 5.0**

Figure 5-2: AOPI Locations

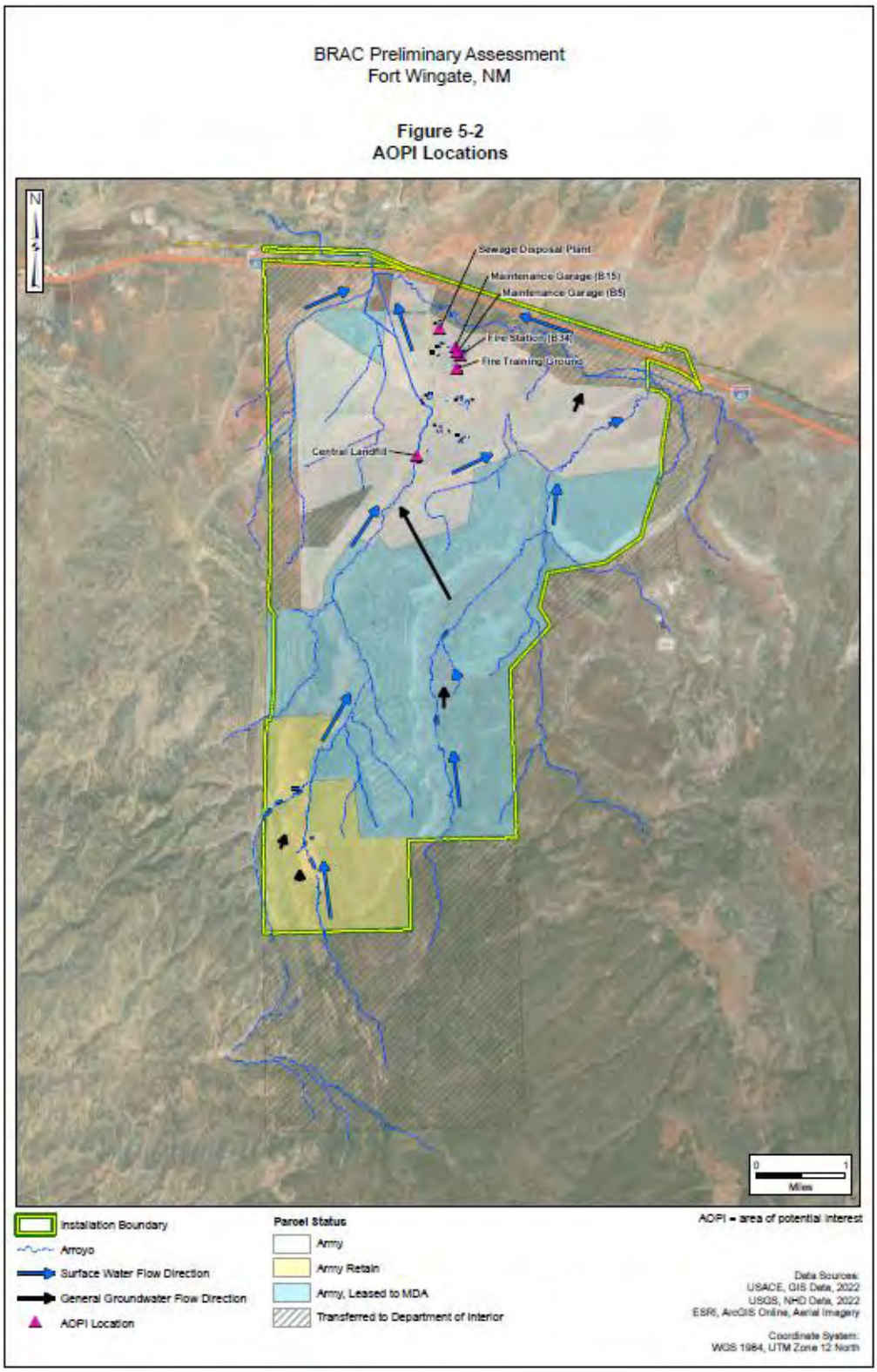


Figure 5-3: Aerial Photo of Fire Station (B34); Maintenance Garage (B5), and Maintenance Garage (B15) AOPIs

Figure 5-4: Aerial Photo of Fire Training Ground AOPI

Figure 5-5: Aerial Photo of Sewage Disposal Plant AOPI

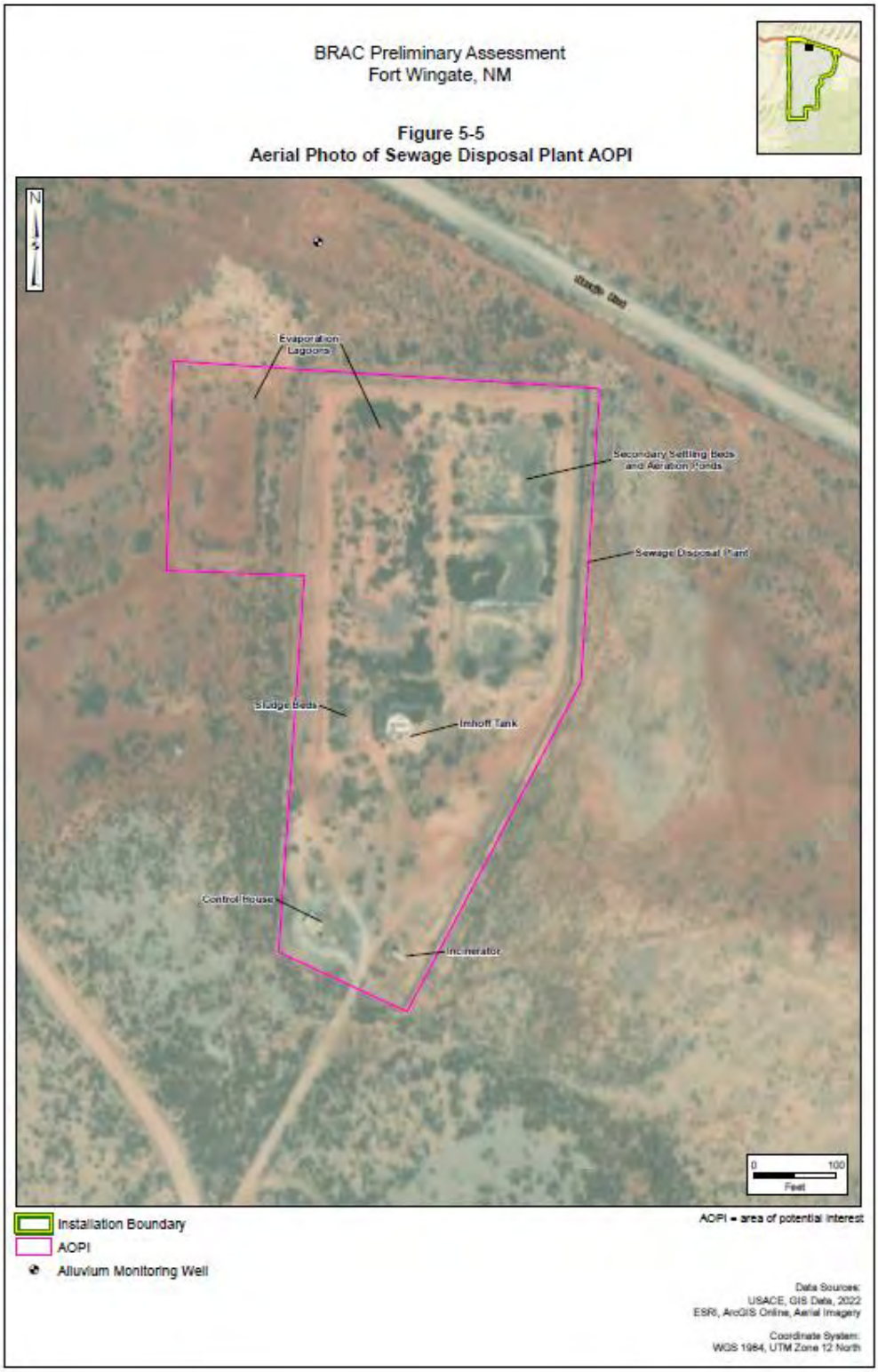
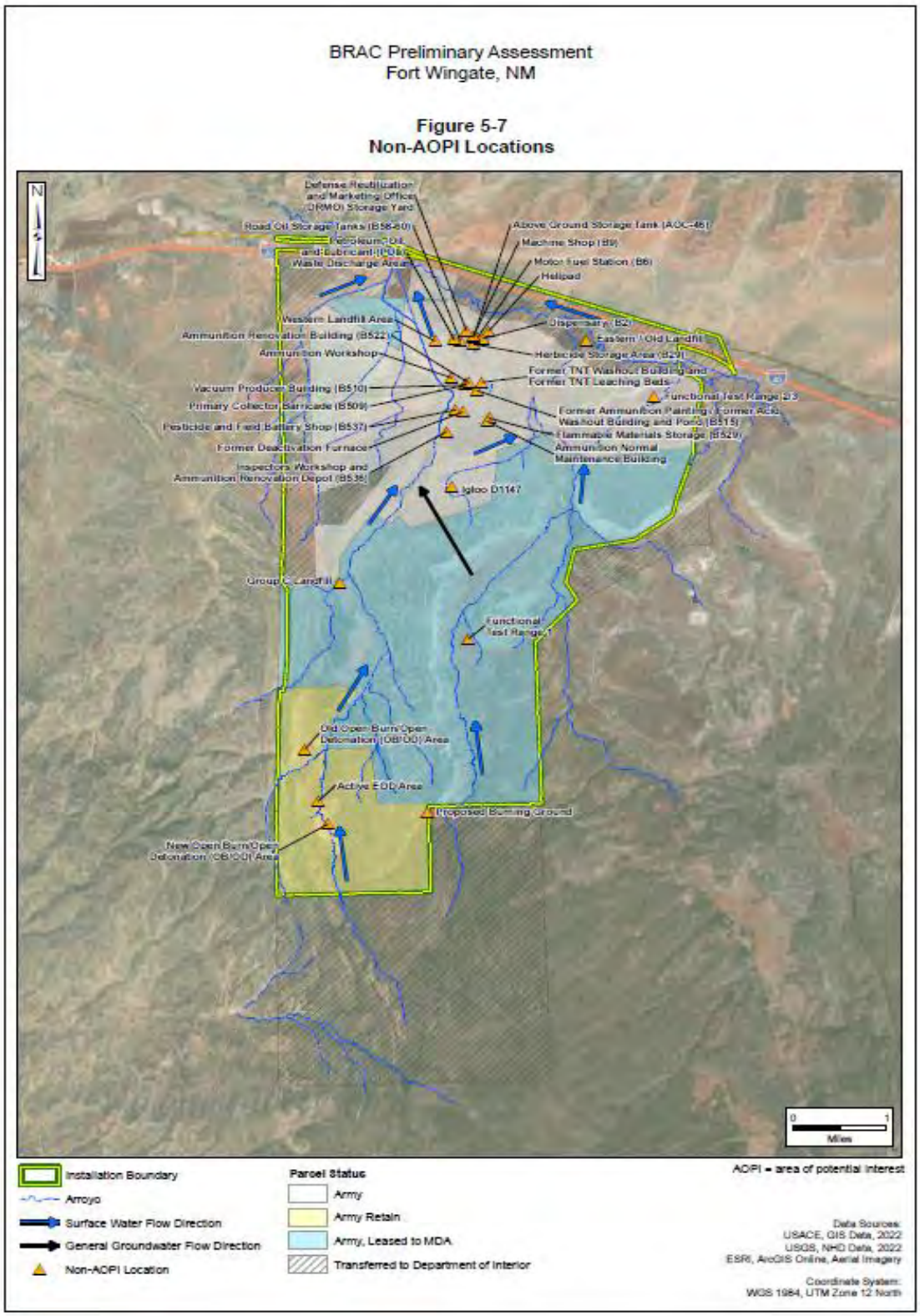


Figure 5-6: Aerial Photo of Central Landfill AOPI

Figure 5-7: Non-AOPI Locations



6.0 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA at FWDA evaluated preliminary locations for the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of PFAS (Army 2018). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify preliminary locations (potential AOPIs) of suspected use, storage, and/or disposal of PFAS-containing materials at FWDA.

Based on the results of the PA for the entire installation, 6 AOPIs were identified. Therefore, further investigation for PFAS at FWDA is warranted at this time. ***Table 6-1*** below summarizes the AOPIs identified at FWDA as well as sampling recommendations for each AOPI.

Table 6-1: Summary of Locations Identified During the PA, Recommendations & Rationale

Location Name	AOPI	Recommendation	Rationale	Land Ownership
Fire Station Building 34	Yes	Further study in site inspection	Evidence of AFFF being utilized in this area includes interview statements and historical common practice of extinguishing materials for fuel-based fires to be AFFF during the period of use.	ARMY
Building 5 Maintenance Garage	Yes	Further study in site inspection	Probable PFAS containing fire vehicle maintenance and washing being conducted here.	ARMY
Building 15 Maintenance Garage	Yes	Further study in site inspection	Utilization for AFFF storage.	ARMY
Fire Training Ground	Yes	Further study in site inspection	Evidence of AFFF being utilized in this area includes interview statements and historical common practice of extinguishing materials for fuel-based fires to be AFFF during the period of use.	ARMY
Sewage Disposal Plant	Yes	Further study in site inspection	Suspected accumulation of PFAS-containing material from various sources through sanitary sewer system.	ARMY
Central Landfill	Yes	Further study in site inspection	Potentially PFAS-impacted sewage sludge from the Sewage Disposal Plant was disposed of here.	ARMY

Data collected during the PA (**Sections 3** through **5**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA at FWDA are discussed below.

In the years since the BRAC closure recommendation, most DoD personnel associated with the Active Army at FWDA had transferred to alternate assignments, have retired, and/or have passed away. Therefore, interviewees with recollections of historical site activities were typically

unavailable. Additionally, many Active Army records from FWDA were transferred to other DoD facilities and many pre-BRAC environmental records were not available.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, and PFBS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to what is contained in the off post well search results (***Appendix E***).

The searches for ecological receptors and off-post PFAS sources were not exhaustive and were limited to easily identifiable and readily available information evaluated during the relevant records review, installation personnel interviews, and site reconnaissance.

Following the PA evaluation, 6 AOPIs were identified. Therefore, further investigation of potential PFAS impacts as part of a site inspection at FWDA is warranted at this time.

7.0 REFERENCES

ANL. 1990. Enhanced Preliminary Assessment Report, FWDA. Argonne National Laboratory, March 1990. FWDA Information Repository Document Number FW 90-1.

Armed Services Technical Information Agency. 1961. Evaluation of Aqueous Dispersions of TFE-Fluorocarbon Resins (Teflon) Applied as Thin Films to Metal Substrates. 01 August.

Army. 2018. Army Guidance for Addressing Releases of PFAS. September 4. Available online at: https://www.fedcenter.gov/admin/itemattachment.cfm?attachmentid=1150.

Army MU. 1965. Military Specification Lubricant, Fluorocarbon Telomer Dispersion (For Use with Ammunition). MIL-L-60326. 30 April.

CH2M Hill. 2010. Final – NMED Revised RCRA Facility Investigation Work Plan Parcel 6. 30 April.

Department of the Army. 1991. Final Environmental Impact Statement Base Realignment and Closure FWDA. August.

Department of the Army. 1996. BRAC 95 Installation Assessment Narratives. April.

Environmental Assessment and Information Sciences Division. 1990. Master Environmental Plan: FWDA, Gallup, New Mexico. December.

ERM Program Management Company. 1997. FWDA, Gallup, New Mexico, Final Remedial Investigation/Feasibility Study & RCRA Corrective Action Program Document. November.

FWDA. 2008. FY2008 Base Realignment and Closure Installation Action Plan. 19 November.

FWDA Public Trust. 1998. Comprehensive Reuse Plan. August

FWDAUSAG. 1991. Installation Natural Resources Management Plan. July.

Gluege, Juliane et al. 2020. An Overview of the Uses of PFAS – Electronic Supplementary Information 1.

HQDA. 1963. Engineering Design Handbook Military Pyrotechnics Series Part Three Properties of Materials Used in Pyrotechnic Compositions. October

HQDA. 1966. Engineering Design Handbook Military Pyrotechnics Series Part Five Bibliography. October

HQDA. 1967. Engineering Design Handbook Military Pyrotechnics Series Part One Theory and Application. April

HQDA. 1984. Military Explosives. TM 9-1300-214. September

HQDA. 2017. Legacy Base Realignment and Closure Installations Conveyance Progress Reports Section 1: Installations with Conveyances Remaining. October 01

HQDA. 2019. Legacy BRAC Installations Conveyance Progress Reports. October.

Higginbotham and Associates, PC. 1988. Master Plan Report FWDA, Gallup, New Mexico. March.

Interstate Technology Regulatory Council. 2017. History and Use of PFAS. November. Available online at: https://pfas-1.itrcweb.org/.

Interstate Technology Regulatory Council. 2020. Section 3.1 Firefighting Foams. Updated April 14. Available online at: https://pfas-1.itrcweb.org/3-firefighting-foams/#3_1.

James, Edward. 1965. The Development of Plastic Bonded Explosives. 29 April.

Kissa E. 2001. Fluorinated surfactants and repellents (2nd edition revised and expanded) (Surfactant science series 97). New York (NY): Marcel Dekker.

Lohmann. 2020. Are Fluoropolymers Really of Low Concern for Human and Environmental Health and Separate from Other PFAS? Environ. Sci. Technol. 2020, 54, 20, 12820–12828

Metcalf & Eddy, Inc. 1992. Final Technical Plan for the Environmental Investigation (EI) at FWDA.

National Guard Bureau. 1995. ARNG Enclave Requirements for BRAC. March 31.

National Institute for Occupational Safety and Health. 1977. Criteria for a Recommended Standard… Occupational Exposure to Decomposition Products of Fluorocarbon Polymers. September

Olah, L., M. Toohey, and C. Toohey. 2019. RE: Citizen Petition to prohibit OB/OD of PFAS and require a PFAS Site Assessment at HSAAP. 16 July.

OSD. 2019. Memorandum: Investigating PFAS within the DoD Cleanup Program. October.

OSD. 2021. Memorandum: Investigating PFAS within the DoD Cleanup Program. September.

OSD. 2022. Memorandum: Investigating PFAS within the DoD Cleanup Program. July.

Pika. 2015. Final Work Plan, Munitions and Explosives of Concern Removal and Surface Clearance Kickout Area. February.

Tetra Tech, Inc. 2002. Open Burning/Open Detonation Permitting Guidelines prepared for U.S. Environmental Protection Agency Region III Philadelphia, PA. February.

TerranearPMC. 2008. Summary Report of Historical Information Parcel 21. 07 February.

TerranearPMC. 2012. RCRA Facility Investigation Report Parcel 21 Approved Final. 27 August.

Tooele Army Depot. 1997. FWDA: Storm Water Pollution Prevention Plan for a General Storm Water Discharge Permit. Permit #NMR00A37. June.

URS Group, Inc. 2003. CTT Range and Site Inventory, FWDABRAC Property, AR. May.

U.S. Army FWDA Base Transition Team. 1998. Proposed Plan of Action for Group II Environmental Sites. August.

U.S. Department of Navy. 1970. Production of sintered polytetrafluoroethylene films on elastomers. US patent US3511682A.

USACE Fort Worth District. 2013. Final RCRA Facility Investigation Report Parcel 11. March.

USACE Mobile District. 1995. Final Environmental Assessment Disposal of a Portion of FWDA, New Mexico. August.

USAEHA. 1988. Interim Final Report Ground-Water contamination Survey No. 38-26-0307-89, Evaluation of Solid Waste Management Units, FWDA. July.

USEPA. 1991. Guidance for Performing Preliminary Assessments Under CERCLA. EPA/540/G-91/013. September. Available online at: https://semspub.epa.gov/work/11/157081.pdf

USEPA. 2005. Federal Facilities Remedial Preliminary Assessment Summary Guide. July 21. Available online at: https://www.epa.gov/fedfac/federal-facilities-remedial-preliminary-assessment-summary-guide

USEPA. 2016a. Lifetime Health Advisories and Health Effects Support Documents for PFOA and PFOS. EPA-HQ-OW-2014-0138; FRL-9946-91-OW. Federal Register/ Vol. 81. No. 101. May 25. Available online at: https://www.govinfo.gov/content/pkg/FR-2016-05-25/pdf/2016-12361.pdf.

USEPA. 2016 b. Memorandum from the Office of Ground Water and Drinking Water: Clarification about the Appropriate Application of the PFOA and PFOS Drinking Water Health Advisories. November 15. Available online at: https://www.epa.gov/sites/production/files/2016-11/documents/clarification_memo_pfoapfos_dw_has.pdf.

USEPA. 2021. Human Health Toxicity Values for PFBS (CASRN 375-73-5) and Related Compound Potassium Perfluorobutane Sulfonate (CASRN 29420-49-3). EPA/600/R-20/345F. Center for Public Health and Environmental Assessment, Office of Research and Development, Washington D.C. April.

Valluri, S.K., M. Schoenitz, and E. Dreizen. 2018. Fluorine-containing oxidizers for metal fuels in energetic formulations. Def. Tech. 15 (2019): 1-22.

Yeager, J.D., A.M. Dattelbaum, E.B. Orler, D.F. Bahr, and D.M. Dattelbaum. 2010. Adhesive properties of some fluoropolymer binders with the insensitive explosive 1,3,5-triamino-2,4,6-trinitrobenzene (TATB). J. Coll. Interf. Sci. 352 (2010): 535-541.